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ABSTRACT

A study investigating collaborative computer use for writing at the primary level was conducted at a Catholic school in Toronto through videotaping and observation in a first grade classroom over a period of 3 weeks. It was found that the differentiation of tasks by the computer into two types of acts--inputting signs and arranging text--was tailor-made for the division of rights and responsibilities between the writer and the helper for composing, inputting, and arranging text. Consideration of both the benefits and impediments to writing arising from the collaborative practices that were used, led to the conclusion that collaboration should facilitate the development of all the language arts skills, especially in multi-lingual classrooms. Although the advantages of having a helper for acquiring skill as a writer were less clear cut, it seems that having a helper may help the writer to acquire habits of self-monitoring, self-regulation, and developing a sense of audience. Placing the single computer in the classroom near the teacher's desk was found to facilitate both observation and interaction with students. It was also found that students should bring a dictionary to each writing session; helpers should be good instructors and knowledgeable about the computer; the hardware and software selected must have the capability to print multiple copies; the technical helper should be able to offer assistance easily from either side of the keyboard; and the word processing program must be simple to use. (DJR)

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COLLABORATION IN WORD PROCESSING

Education and Technology Series

JAMES L. HEAP, Principal Investigator
SHAWN MOORE

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The Honourable Sean Conway, Minister

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ABSTRACT

In May, 1984 the use of a word processing program in a Grade 1 classroom was videotaped and observed. Some writers required the aid of other students in order to use the program and operate the computer. The work of writer and helper is herein analysed as collaborative writing.

The research had three objectives:

1. to report on the structures and practices of student collaboration;

2. to formulate the advantages and disadvantages of allowing student helpers;

3. to suggest how collaboration can be organized at the Grade 1 level to take full advantage of student "experts" at the computer.

In order to meet the first objective, it became necessary to comprehend how the computer, as a medium of expression, affects the way in which writing is done. Reflection revealed that it differentiates the task of "transcribing" thought into two types of acts: inputting signs and arranging text. This differentiation is reflected in the division of rights and responsibilities between the writer and the helper for composing, inputing, and arranging text. One student is found always to have responsibility, while both have some form of right to act. The type of collaboration observed seemed tailor-made to the computer as a writing medium.

Under objective one, composing, inputting, and arranging practices were discovered. Composing practices consisted of offering candidate story parts, using a cloze procedure, and oral reading of the displayed text. These practices solved the interactional problems in collaboration of achieving a sense of "where we are" and "what to do." Inputting included solo and collaborative acts, both of which typically involved verbalization of the word to be input. Verbalizing was usually combined and synchronized with practices of keyboard searching and screen checking. Arranging, via the use of "executive keys," was carried out through helper instruction, as well as by solo acts of the helper or writer. Arranging also included competition for physical access to the computer.

Under objective two, general advantages and disadvantages are discussed. Attention is given to the benefits and impediments for writing arising from the use of the three composing

practices and the practices for inputting. If the teacher is concerned with the development of all the language arts (speaking, listening, reading, and writing), the recommendation in favour of allowing collaboration is unequivocal. Collaboration during word processing is especially useful in multi-lingual classrooms.

Collaboration seems virtually necessary for those Grade 1 writers who have not learned to use the computer. The use of a helper with such students saves time for the teacher, who otherwise would be cast in the role of helper. However, the advantages of having a helper for acquiring skill as a writer are less clear cut, in part because there are different ways of organizing collaboration and this research examined only one way. It seems, though, that the practices of collaboration may help the writer to acquire habits of self-monitoring and self-regulation. Having a helper may also aid in the development of the writer's sense of audience.

Under objective three, several topics are addressed. Attention is given to how the computer centre should be laid out if there is only one computer in the classroom. Suggestions are offered for the use of student "dictionaries." Advice is provided on how helpers should be encouraged to develop in light of a need for a pool of both male and female helpers. The advantages are cited of having a second video monitor attached to the computer, facing the whole class. Hardware and software solutions are proposed for the problem of under-utilization of student time and of the computer during the printing of multiple copies of a student story. Finally, attention is given to what hardware and software best facilitate student collaboration in word processing at the Grade 1 level.

Concluding remarks are offered on the importance of attending to the new possibilities for education that the computer, and collaboration at the computer, open up.

It is widely agreed that, at present, word processing is one of the best uses of computers in schools. This is certainly true in the area of language arts, where the use of word processors combines both writing and reading skills. However, an obstacle to the introduction of word processing is that it can, at least initially, add to teachers' workloads. A software program has to be taught, instructions have to be repeated and explained, programs crash, paper jams or runs out, students constantly show up at the teacher's desk with another story or draft to read. One recommended solution to this workload problem is the use of "helpers," students whose expertise with the computer, word processing program, and printer is beyond that of other students in the class (cf. Miller 1984). The research reported here is a pilot study that examines the bases and structures of collaborative efforts of students in a Grade 1 classroom during word processing.

This report is organized in two parts. Part 1 provides background information and frameworks for discussing work towards the three objectives of the research. Part 2 addresses each objective in turn.

PART 1

Objectives

It can be expected that students at the Primary level, where word processing is still little used (TV Ontario 1982), need significant help with computers. Indeed, there is some question as to whether word processing should be introduced at this level, given the limited reading and motor skills of these students. Further, there is very little by way of word processing software that can meet the needs of Primary students, and is usable by them.

The first objective of this research project was to analyse the bases and practices of student collaboration during writing at a computer. In carrying out an applied ethnomethodological study of these ways of collaboration it became necessary to understand the nature of writing collaboratively at a computer. The research developed a needed, but rudimentary, conception of how writing at a computer is achievable through an enforced distribution of rights and responsibilities between the writer and the helper.

Based on an examination of writer-helper interaction, the second objective of the research was to develop initial conjectures as to the advantages and disadvantages of allowing students to be helpers in story composition. In light of analyses of interaction, and conjectures as to sensible uses of helpers, the research's third objective was to raise issues and to offer suggestions as to how collaboration and word processing ought to be organized at the early Primary level. These suggestions focus on the physical and social organization of computer use, as well as upon hardware design and software interface appropriate to collaboration.

Research

Data were collected in a Grade 1 classroom at a Catholic school in a prosperous working-class section of Toronto. Videotaping and observations were done during a three week period in May, 1984. Earlier observations had been done for one week in October, 1983, while students learned to use the computer and the word processing software. The data consist of fieldnotes and thirteen and one-half hours of videotape of students working at a computer. The teacher was interviewed, and copies of the students' computer-written stories were collected. The teacher, Mrs. Sharon Purdy, was unique, in that she and her husband, Mr. Thomas Purdy, developed and designed the word processing program, Write/One, used in the classroom (Purdy and Purdy 1983). The 1983-1984 school year was the third year Mrs. Purdy had used the program in her classroom, but the first time it had been used at the first grade level. Each year she allowed and encouraged students to help each other while working at the computer. Besides teaching and co-developing the software, Mrs. Purdy acted as a consultant to this research project.

Only one computer was used in the classroom, an Apple II+, lent by the Apple Corporation of Canada, to use the version of Write/One designed to run on the Apple II series. One disk drive was used, with a black and white monitor. The computer was connected to an Epson MX 70 printer, placed to the right of the computer on a trolley, with a stack of continuous feed paper placed on the shelf below the printer.

The computer itself was placed on a student desk, with two to three desk chairs clustered around the computer desk and trolley. The computer centre was located in the southeast corner of the classroom (see appendix 1) facing the right side of the teacher's desk. The teacher's desk was along the south wall of the room, at the east end of that wall. Sitting at

her desk the teacher was at a right angle to rows of desks, occupied by the twenty-three students in the classroom. The desks faced the "front" of the classroom, which was the east wall, where blackboards were placed. The "back" of the classroom consisted of counters and cupboards, with the writing centre being a table located in the southwest corner of the classroom.

The placement of one other object in the classroom is worth mentioning. At the south end of the east wall, next to the computer centre, was a large television, on a tall stand (see appendix 1). The television was angled so that all the students in the class could see the screen. The TV was connected to the computer and operated as a second video monitor. Whatever appeared on the computer's video monitor appeared simultaneously on the large TV. Hence, every student at a desk, at the writing centre, at the back of the room, or at the west side of the teacher's desk, could see where the writer was in using the Write/One program. Everyone had an opportunity to read the story as it was input.

The teacher reported that students watched the TV monitor to varying degrees. When they saw words that were misspelled, or punctuation that was wrong, they were allowed to go up to the writer and point out the mistake on the computer's screen. Or, as I observed, they might call out to the writer, usually in a loud whisper, that there was trouble on the screen. Students also were able to know when the writer's turn was finished by watching the TV monitor. Turn order followed the path of student seating in the classroom, from the front of a row, to the end of it, then back up to the front of the adjacent row, and down that row.

If the child whose turn it was next did not immediately come forward, other students notified that child that it was her or his turn at the computer. They would not brook a waste of time in the new writer getting over to the computer. As well, some students seemed to keep track of whose turn it was next, so that after a recess or some interruption, someone always knew who was next, and would say so, if the question was raised. Because of student interest, and the presence of the TV monitor, the teacher was saved the bother of monitoring order and of verbally allocating turns at writing.

The collaboration observed in the first grade classroom was widespread, and occurred in each phase of story composition. At the computer centre the person whose turn it was to write would choose a helper, and perhaps allow another student to join in the collaboration as well. The helper position in the classroom arose somewhat spontaneously, according to the teacher. Each year in her class, the students who were the quickest to pick up the fundamentals of

using the computer for story writing would hover around the computer, offering advice, until an actual position called "helper" was institutionalized by the teacher.

During my observations of the collaborative production of ten stories, six students acted as helpers. For three stories there were two helpers at the computer at the same time, while there was only one helper for the other stories. Of the six helpers, one helped in six stories, another helped in two, and the other four helped with only one story each. The student who helped the most, not surprisingly, was the one who knew most about the computer. It was his responsibility in the morning to turn on the computer and the printer, and to load the software. When the system crashed, he came up to solve the problem. At the end of the day he withdrew the floppy disk, turned off the machines, and unplugged them. The student was chosen to do these tasks by the teacher because he quickly learned how the hardware worked and how it needed to be operated in order to use the word processing software.

At the computer centre, the writer and helper interacted continuously around appropriate responses to program instructions, story titling, sentence development, inputting, arranging the text, using student dictionaries, and closing and printing a story. After printing a hard copy, and having it corrected by the teacher, typically with the writer and helper involved in the correction process, students collaborated in editing/correcting the story on the screen. They then would run off copies of the story for all students in the class. All of these collaborative activities were videotaped, but the analytic focus of this pilot study is upon the interactional work whereby writer and helper produce a first draft of a story.

Review of the Literature

(a) Research on Collaboration Outside Word Processing

Research on collaboration in contexts other than word processing include: studies pertaining to the activities of more than one writer with paper/pencil as the medium of instruction, and studies focusing on the activities of more than one student using computer-assisted software other than word processing packages. Although the generalizability of their findings appear limited, these studies raise important questions regarding the role of social experience in classroom learning activities and, specifically, the dynamics of peer helping relationships. Examples of these types of studies follow.

Petitio and Newman (1984) organized second grade children into "turn-taking" and "collaborative" groups in order to study problem-solving strategies while working at the computer. Teachers acted as advisors during sessions. The authors discovered that discourse in the "turn-taking" group was less and the "quality" of talk was different. In short, the "collaborative" groups demonstrated a strikingly higher level of interaction, particularly in relation to the "products" of the computer games. The authors do not claim that collaborative interactions teach "problem-solving" or "logical thinking". For the most part they raise questions for further research into how different group interaction models affect problem-solving processes and internal, individual cognitive growth.

Dyson and Genishi (1982) considered the "interactive process" of writing in primary school children, using paper and pencil as the medium of expression. Their work touches upon a theoretical interest that is congruent with my study, namely, the conceptualization of writing that posits a transition in language use from conversation to composition (Bereiter and Scardamalia 1982). In their study of two students, Dyson and Genishi noted a practice of "sounding out" words in the effort to spell them. The practice was used in both solo and collaborative writing. Claiming that interaction with others may have fostered the development of a sense of audience, the authors concluded that "children's interaction had positive effects on their ability to write" (p. 130).

Social effects of the use of microcomputers in elementary classrooms, where children were learning to program in LOGO, have been documented by Hawkins et al. (1982). Important aspects of this work hold topical similarity with my inquiry's focus on discourse formats and the role of student helpers. The authors analysed collaborative conversations ("types of interaction turns"), and discuss children's perceptions of their peers as "helpers" during LOGO exercises. In their summary, the authors point out that their research suggests the potential impact of the technology lies at the level of the social life in classrooms. "In order to anticipate developmental and educational consequences of the microcomputer, we must broadly examine the ways in which it may affect children's experiences" (p. 272). In short, Hawkins et al. share this research's interest in questions concerning student helpers as computer "experts" (e.g., those able to provide a supportive role to their less technically competent peers.)

(b) Reports Pertaining to Collaboration During Word Processing

Reports contained within this category are primarily anecdotal and suggestive in terms of my interest in student-student collaborative structures. At this time, though, there are research projects underway that should tell us more about collaboration during word processing. It does not appear, though, that these studies have engaged, or will engage, in the level of micro analysis required by objective one of this study.

A notion of "teamwork at the keyboard" is addressed in a study of secondary school ESL students engaged in word processing tasks (McCahill 1984, pp. 74, 75). While this image of more than one writer working at the keyboard is compatible with my focus, the author does not provide analyses regarding how text production is achieved co-operatively. While imaginative and useful, none of the nine tasks that McCahill proposes requires students to compose a story at the keyboard. She recommends conferencing, but, as with the work of Graves (1983), such interaction does not occur while a story is being written.

Barker and Canale (1984) observed elementary school students using a variety of word processing packages. They report that lack of typing skills for young children did not present an obstacle of the difficulty that had been expected by some teachers and researchers: "given the ease of correcting mistakes, 'hunt and peck' methods were easier than handwriting. Some students helped others with entering the text from a handwritten first draft" (p. 5). The authors provide the following general observations:

-the mechanics of using the computer may become an obstacle for some children in expressing their ideas through writing;

-some word processing packages appear to encourage attention to "superficial and cosmetic aspects of writing" (p. 6);

-software for word processing "provides no means for the teacher or learner to keep a record of changes made, keystrokes used, and time spent writing on different portions of the text" (p. 6).

According to Barker and Canale, the most creative uses of word processing software (e.g., networking) are more accurately termed "language processing" or "idea processing". Based upon their own experiences, and review of others' work in the area of computers in the classroom, the authors conclude that "the proper focus of concern should not be with the technology per

se but with the way we use it--and particularly with the forms of social organization that develop as we use it" (p. 10). This important point motivates this research on collaborative uses of the computer, and is a point often missed in discussions of the impact of technology on education. However, it should be appreciated that the technological medium itself offers unique possibilities for collaborative student relationships during the writing process. Furthermore, ergonomic factors play a limiting and shaping role in the evolving structures of collaboration during story composition, inputting, and revision of ideas.

Let us turn to a number of University of California, San Diego research reports that include discussions of collaboration during word processing (Levin et al. 1983; Levin and Boruta 1983; Mehan et al. forthcoming; Riel 1983).

Riel (1983) asserts that the computer medium offers new possibilities for social organization and identifies collaborative arrangements and social effects:

-computers facilitate co-operative work between children that is difficult with the paper and pencil medium;

-the presence of an "other" during the writing process facilitates problem-solving in generating ideas and immediate responses to the written text;

-computers create "functional writing environments"; that is, contexts with a purpose and an immediate audience for the children's stories.

Corroboration of Riel's observations is provided by Levin and Boruta (1983) who report that "students share the mechanical task of writing by alternating typing turns, letter by letter, word by word, phrase by phrase, sentence by sentence. We have seen children divide up the task of capitalization with one child pushing the 'shift' key and the other typing the letter.... Once the mechanics of collaborative writing are overcome, we have found that children working in pairs on the computer create social/communicative environments that enhance the benefit of the writing assignment" (pp. 292, 293).

Researchers working at UCSD who have studied elementary school children working together during word processing, are beginning to re-examine conventional formulations concerning what writing is and what it may become. "Most approaches to computer use and writing presume a lone individual, working in at least temporary isolation. We have uncovered many reasons for challenging this presumption. Many people have suggested the value of collaborative writing, but it is difficult to share a pencil, or to write a text collaboratively on a piece of paper.

It is much easier to divide up the work of writing on a word processing system. The display is more public and legible..." (Levin et al. 1984, p. 7). The research to be reported in this monograph shares this concern with how writing and computer use have to be reformulated to handle the properties of collaboration. In generating these reformulations we should come to a better understanding of the place and importance of the public, legible character of computer displayed writing.

Finally, Dickinson's recent research (1985) is noteworthy, as he examined both solo and collaborative writing, with pencil and paper and at the computer. His observations were carried out in a combined Grade 1 and 2 class in a multi-racial, multi-cultural classroom in the Boston area. While not using videotape, he did audiotape and transcribe collaborative sessions at the computer. He found planning and self-monitoring to be relatively common between children writing collaboratively. However, the type of collaboration he observed appears to have been different than what I observed. His collaboration seems to have been between joint authors, whereas mine was between a writer and a helper.

While favouring collaborative writing, Dickinson noted one possible disadvantage. He reports that, while "collaborative writing fostered conversations rich in metalinguistic content, [collaboration] also resulted in higher levels of off-task behavior than solo computer writing or solo paper and pencil writing" (p. 2). Dickinson discovered patterns in the ways students went off-task, but acknowledged that there are difficulties in measuring off-task behaviour during writing.

From reviewing work on collaboration during word processing, it is clear that it is a topic that recently has excited the interest of excellent ethnographic researchers. As of yet, the bulk of that research has not been published, but should be available within the coming year.

(c) Theoretical Implications of Collaborative Writing

Theoretically, collaborative writing at the computer is interesting because the story ideas and text creation are socially mediated. However, most theories of writing dichotomize the processes of composition and text production (e.g., Flowers and Hayes 1981; Smith 1982). Because this inquiry addresses the simultaneity of idea generation and story text production, we can speculate on the possible facilitative effects of a immediate "other" (student helper) present to cue topic choice, development, and continuation of a composition (cf. Bereiter and Scardamalia 1982). Collaborative discourse appears to occupy a middle ground between

conversation and composition. An examination of the videotapes from this study reveals that writers (and helpers) often freely associate ideas as "candidate parts" for inclusion in their story text. This free association seems to be behaviour covered by Bereiter and Scardamalia's (forthcoming) concept of "knowledge-telling".

An issue for studies of collaboration is to what extent a "knowledge-telling" strategy is used in collaborative, as compared to solo, writing conditions. The research reported here examines only collaborative writing. As such, I will be concerned with only the nature of the knowledge-telling strategy as it is employed in social interaction.

(d) Conclusion of the Literature Review

The structures and features of collaborative writing cannot be fully accounted for under existing theories of the writing process that conceptualize a solitary writer engaged with some medium of expression. This is because collaborative discourse introduces social interaction into the writing process. The review of the literature on writing processes and collaborative discourse found no studies that concentrated systematically on how collaboration is done at the computer during story composition and inputting. Nor am I aware of any work that begins to address the implications of student writer-helper collaboration for leading cognitive theories of writing. Those studies that address student-student collaboration during word processing are largely anecdotal and summative. Reports so far published do not offer analysis and interpretation of the structures, strategies, and practices of writer-helper collaborative relationships.

Applied Ethnomethodology

The approach taken in this research is what I call applied ethnomethodology. While rooted in a reading of the work of Garfinkel (1967), Cicourel (1973), and Sacks and his colleagues (cf. Sacks, Schegloff, and Jefferson 1974), the reading is not assumed to be one with which all readers would agree. I am less concerned, frankly, about agreement here than I am about how my version of ethnomethodology can be put to use. Let me here provide a sense of what ethnomethodology is, the framework it uses, the method that I have found rewarding to use, and the way in which ethnomethodology can be used as an applied science. These remarks

will have a generality that exceeds the needs of this research report, but are nonetheless important to make, because ethnomethodology still is not well known in educational research circles. Of course, these remarks cannot stand as anything but an advertisement for ethnomethodology. They are insufficient as an introduction or explanation.

Ethnomethodology is the study of the practices used by members of a culture to organize their reasoning, actions, and interactions, as recognizable, intelligible, orderly (i.e., rational) events in a social world. I regard the essential aim of ethnomethodology to be the generation of knowledge about how human events possibly can be organized, culturally. My animating interest is in recovering the culturally possible ways in which events can "happen" (i.e., how they can be organized by members of a culture, such that they can be recognized, and taken for granted, by members of that culture).

Ethnomethodology is not concerned, ultimately, with actual contingent events knowable only through sense experience. Ethnomethodology is concerned with the necessary, possible ways such events can be organized. These ways can be known only from within a culture, by being, or becoming a member. The ultimate aim of (my) ethnomethodology is to generate a priori judgements about event organizations that are necessarily true in the social worlds where these events can occur. A priori is used here simply to denote the fact that the structures of reasoning or activity organization studied are structures already forged in the culture as standard, but modifiable, ways of acting. These ways stand as resources within the culture.

The theoretical framework of ethnomethodology is a child of phenomenology and analytic philosophy. From phenomenology comes a theory of consciousness as a relation between the object-as-known, and the acts through which the object is known. Methodologically, this part of the frame leads to a situated perspective: activity organization is viewed from the perspective of its unfolding, its accomplishment in real time, in situ. From analytic philosophy comes the notion that language provides both resources and limits for what can be said about events. Methodologically, this part of the frame leads to the requirement that activity organization be formulated from the perspective of what members (i.e., speakers of some culture's language) could understand, could recognize and identify the activity to be. In all this, remember that the ethnomethodologist is also a member of the culture he or she studies. It is by being a member, by sharing the know-how for reproducing activity organization, that the ethnomethodologist can be an analyst and show how activities can be produced.

In unraveling the complexities of student interaction, I am trying to explicate the culturally possible ways we have to organize behaviour around tasks. In line with the ethnomethodological requirement that claims about activity structures be based on audio-visually recoverable evidence, I view and review videotapes repeatedly to discover and gather the reminders, the evidence, that support my explication of a priori claims. This work is aided by the production of selective, detailed transcripts (see appendix 2). As reading these transcripts requires familiarity with an arsenal of conventions (see appendix 3), this report will not rely on transcripts for the presentation of claims.

The primary method used in analysing videotapes and transcripts could be called "possibilizing." The term is suggested by Zaner (1973), but its intent and form as a method derive directly from the work of Husserl (e.g., 1969). It is my belief, though, that the method receives lively use in the work of Wittgenstein (e.g., 1958). As well, what is referred to as the "comparative method" in the social sciences (cf. Marsh 1967) is a type of possibilizing, one that restricts itself to actual occurrences of phenomena of interest. Possibilizing, as articulated in philosophy, treats both actual and possible occurrences of the phenomena of interest (cf. Heap 1980, 1981).

Essentially, the method, as a set of procedures, consists of examining data, in this case videotapes and transcripts, to locate patterns of discourse and physical actions. Abstracting from the data, I idealize the type of structured phenomenon that they can be taken to exemplify. In this way I reach the context-transcendent level of "strategies," and "practices."

Using an idealization of the interactional structure, I return to the data to see if, and how, strips of videotaped interaction can be treated as possible examples of the idealized pattern. The videotapes offer resistance to my interpretations, by not fitting them well or adequately, forcing reformulation of what the structure might be. By imaginatively varying properties of the structure, I can begin to trace the practices of collaboration in composing and in inputting and arranging text. The research thus recovers culturally possible ways in which collaboration during writing can be seen to be organized at the Primary level.

Finally, the sense in which my ethnomethodological efforts are applied is that the findings, the practices located through ethnomethodological inquiry, are used as the basis for addressing practical organizational problems. In the case of my inquiry, those problems are formulated as the second and third objectives of the research. Knowledge of how collaborative writing can be organized at the computer allows me to make reasoned conjectures about the advantages and disadvantages of allowing a helper. Such knowledge also gives me grounds for

suggesting how word processing and collaboration can be organized efficiently at the Grade 1 level.

Conceptions

To meet the three objectives of this research, it is necessary to formulate the relation between interactants in terms of the task demands of writing at a computer. And, moving one step further back, to formulate these relations requires some understanding of how writing becomes differentiated and transformed when it is accomplished by more than one person, using a computer, rather than pens and paper. In order to establish the bases for meeting the three objectives, I shall focus on conceptions of computers, writing, and interaction.

(a) Conception of Computer-in-Use

A theory of collaborative word processing requires a theory of computer use, which we lack. To appreciate just how major the lack is, in spite of twenty-five years of human factors research (cf. Kantowitz 1983), consider the conceptions of hardware and software available in the literature. Every dictionary of computer terms that I have been able to find defines software as programs for the computer (e.g., Sippl 1983, pp. 352-353). Yet users do not encounter software in this limited sense. They encounter software as programs for the user, though the programs, as in the case of word processors, are not encountered as computer programs, written in a computer language. In the absence of user-oriented conceptions of hardware and software, I shall use the term "computer" to mean hardware and software as encountered from the perspective of the user. Context should make clear where I depart from this usage.

(b) Conception of Computer Writing

Research on writing has been along two lines, one concerned with features of the environment that are consequential for the meaning writing has for writers (e.g., Britton et al. 1975), and the other concerned with the cognitive processes of writing (e.g., Flower and Hayes 1981). It has been suggested that linkages between these two lines of work can be forged using cognitive theory and ethnomethodology (Scardamalia and Bereiter forthcoming).

This research takes up the former theme, treating the presence of the other person, and the use of the computer, as seminal aspects of the task environment (cf. Flower and Hayes 1981, p. 369). These aspects involve and require cognitive processes that either differ from those normally treated by cognitive theorists, or produce an alteration of how those processes come to produce text. Collaborative writing at the computer opens up new areas of research for cognitive science, in that theories of writing cannot be transported fully and in unmodified ways from the domain of handwriting (or even typewriting) by a solo writer, to the domain of word processing by two or more persons.

One difficulty with extant theories of writing, with rare exception (Bereiter 1980), is that they often mistake typical features of writing with pen and paper for essential features of writing. When the computer is used as the medium of expression in writing, a distinction must be introduced within the framework proposed by cognitive theorists. Those theorists distinguish two components of writing. The first is composing, involving idea generation and the arrangement of ideas in language. The second is the actual manipulation of some medium of expression, like a pencil, which is called "translating" by Flower and Hayes (1981), and "transcribing" by Smith (1982). For reasons that will become apparent, I prefer the latter term, but both make reference to moving ideas into conventional, physical representations of thought.

In using the computer to write, we still compose, but transcribing becomes differentiated into two types of operations. In phenomenological terms (cf. Husserl 1962), the operations have three components: act, instrument, and object. They are organized as follows:

ACT	>>	INSTRUMENT	>>	OBJECT
1. inputting		display keys		signs and symbols
2. arranging		executive keys		text

Acts of inputting operate through, and on, display keys to produce signs and symbols on some type of display screen. Acts of arranging operate through, and on, executive keys to arrange the signs and symbols on the screen. Transcribing acts are defined as inputting or arranging in terms of their effect on the display screen. While the keys achieve these effects, they do so in ways much more complicated than the ways in which other instruments, such as pencils and even typewriters, achieve their effects. Glossing over much that needs examination, it can be said that keys are indexical: their effects are program dependent. What may achieve the display of a sign on the screen at one point in the use of a program, may at some other point achieve an executive effect on the text. For example, in the word processing program

WordStar, depressing the "D" key at the "No-File Menu" initiates the sequence for opening a file to edit. Whereas, within a file, depressing the "D" key (alone) produces a "d" on the screen.

The differentiation of the computer keyboard, as supported by a software program, makes possible the differentiation of writing qua transcribing, into acts of inputting and arranging. Some keys are used to achieve displays on the screen, while others are used to move the cursor, to delete signs and symbols, to bring up new screens, or windows on the screen. Executive keys are also used to move text around on the screen, and to move text to, and off, the screen. Depending on the computer hardware and software, some keys will allow text to be inserted in certain ways on the screen. Some keys, when depressed in tandem with display keys, produce a further set of displays, such as upper case letters, and symbols such as !@#$%z&.

(c) Conception of Collaborative Writing as Talk

Collaboration during writing consists of social interaction between the writer and the designated helper. The latter is the student chosen by the writer to be present during the writing session, and to lend her or his expertise, as needed. This interaction, as a normative and moral phenomenon, is quite complex. The following only begins to unravel these complexities.

The only way that the helper can help, the only way that it makes sense to allow students to be present together at the computer, is if one thing is continuously attempted and accomplished with some degree of success. The writer must convey, directly or indirectly, what it is that he or she is doing. The writer must make visible her or his behaviour as action oriented to the goal of producing text on the screen. On the other side of the relation, the helper must make visible her or his behaviour as action also oriented to the goal of producing the writer's text on the screen. How is this done?

Not surprisingly, it turns out that writing at the computer, with two or more persons involved, is done in talk. Writing is talk. That is to say, composing is done "aloud." Also, though, the "transcribing" of this talk into electronic text is done in talk. Inputting as it occurred during collaborative writing in my set of videotapes was bi-modal. It was done as physical acts, of finding and depressing keys, but also as verbal acts of pronouncing the letter being input.

Not all displayed signs and symbols were pronounced. In inputting a string of signs (i.e., a word) some of the letters typically were pronounced. The ordering of inputting and pronunciation was not consistent across stories or within stories. Pronunciation might precede, follow, or coincide with a display key being depressed. There was one circumstance, which was fairly common, where pronunciation preceded or coincided with inputting, but rarely followed it. This was when the spelling of a word was dictated by one student while the other input it. Either the writer or helper might do the spelling.

The one part of collaborative writing at the computer that was not done in talk, or with a verbal accompaniment, usually, was arranging. The helper usually arranged the text (i.e., hit the space bar, the delete key, the cursor keys, the shift key, etc.) without naming the key/function with which he or she was concerned. In the use of two keys, though, verbalization sometimes did occur. Helpers sometimes said "space" when they hit the space bar. In the rare cases when this occurred, it sounded as if the helper was teaching or reminding the writer that a space was required. The other key whose name was pronounced was the return key. This key was pressed to end a writing session. Uttering "return" seemed to work as a verbal marker for the end of writing.

(d) Conception of Talk as Ordered Interaction

Collaborative writing is talk, and, like other talk between competent speakers, it is organized in typical, uniform, repetitive, relatively cohort-independent ways. The turn ordering system, on the face of it, is quite similar to that found in naturally occurring conversation (cf. Sacks, Schegloff, and Jefferson 1974). Either party can self-select to be next speaker. Speaker turns can be designed to achieve next speaker selection. Turns have transition relevance places, where the next speaker can join the conversation. However, an adequate rendering of the turn ordering system has to note its character as a system carrying designs sensitive to the task of producing text on a screen. The turn ordering system must be understood as task sensitive, in ways yet to be discovered.

In particular, theorizing about the turn ordering system apparent in the videotapes must account for the properties of the talk that are sensible in the setting, but that would be quite odd if encountered in most other settings. While writing at the computer, turns at talk seemingly are not directly referential. That is, talk that composes the text is rarely talk

about the text. Instead, composing talk is a verbal rendering of what the text could be, or what it can be read to be. In its former guise, composing talk consists of offering "candidate story parts." In its latter form, composing talk, or what counts as composing talk, consists of reading aloud what the text-so-far says. The latter is often accompanied by movement of a finger along the line of screen text being read, an action that I call "finger reading."

The second property of talk that a turn ordering system would have to account for is the pronunciation of the signs that are being input. These verbal renderings count as turns at talk because the speaker has the floor: the other person rarely speaks while signs are being pronounced, unless it is to repeat the sign, as when the sign is being dictated for inputting.

Persons do not speak just in order to produce the regularities discovered by conversation analysts. Talk, especially during collaborative efforts, is task oriented. At least, hearers have the right to expect that talk will be so oriented, although there is always room for disappointment. The relationship between discourse structures and task are not as well understood (cf. Heap 1983). During collaboration, it appears that self-selection to speak, and the choice of what to say, reflexively establishes and presumes a distribution of rights and responsibilities in relation to the task, and in relation to the auspices for each speaker being engaged in that task. The formulation of these rights and responsibilities falls under objective one of this study.

PART 2

Objective One: Rights and Responsibilities

The first objective of this research is to describe and explicate the functions of typical structures of collaborative interaction. These structures are produced by interactants in the course of, and by way of, exercising the rights, and meeting the responsibilities that they invoke and enforce in the setting. Only by understanding the relation between writer and helper, as these persons work to establish these relations, can we understand the practices of collaboration in which they engage.

To begin with, it has been said that the helper must display an orientation to the goal of producing text on the screen, but the text is not supposed to be her or his own. It is the writer's turn to write, and that makes the story the writer's story, not the helper's story. Ownership of the story seems to flow from the allocation of a turn to write at the computer. As it is the writer's story, and the writer selects the helper (or at least allows someone to self-select to be a helper), the helper's contribution to what appears on the screen is allowed to stand only if "authorized" by the writer. As the helper is there only in a technical capacity, because of her or his superior knowledge of the computer, the helper is not a full-fledged collaborator. A jointly authored story is not a sanctionable aim or expectation of parties to the setting.

From analyzing interaction videotaped over a three week period, it is possible to formulate the normative orders invoked, to some extent, and enforced, to some extent, in one class, at the end of the school year. What follows is an analyst's rendering of the social organization of apparently enforceable expectations of writers and helpers. The expectations are not offered as causing the behaviour observed. Instead, the claim being made is that these expectations could be, and were, invoked or implied at various points, as normative orders appropriate in the setting. These are the rules students tried to use and tried to enforce, not ones they necessarily lived by:

The WRITER has	The HELPER has
1. right and obligation to compose, responsibility for what is composed	1. appurtenance to compose
2. right to input, responsibility for inputting	2. licence to input
3. right to arrange	3. right to arrange, responsibility for arranging

These rights and responsibilities dove-tail in intricate fashion. One person always has responsibility, while the other has some form of freedom to engage in the activity.

(a) Level One

The writer has the right to compose, and must exercise that right (i.e., he or she is obligated to compose). Whether the writer composes a part of the story or not, he or she has responsibility for what appears on the screen, and was treated by the teacher as having responsibility for the hard copy of the text.

While the writer has the right to compose, the helper has only the appurtenance, the incidental privilege, to compose. If the helper is understood as a technical aid, there because he or she knows better than the writer how to operate the computer, then we would not expect the helper to be involved in composition. But on my videotapes helpers were always involved at some point in composition.[1] However, they were involved only in an incidental fashion. They rarely initiated the offering of candidate story parts. The writer was the one who proposed an idea, or, more often, the wording of a possible story part. Helpers' contributions consisted largely of offering words that could be used in the writer's story. This involves a practice that will be discussed below.

Evidence supporting the formulation of rules for composing, as rules that interactants could invoke, comes in various forms. Helpers rarely initiated story parts. When they did, they were rejected as in some way odd, or they occurred, and were accepted, as solutions to dead ends in story development. As evidence of the writer's right and obligation to compose we have the recurrent fact that helpers waited for writers to formulate candidate story parts for a next sentence after inputting the previous sentence on the screen. The claim that the writer is responsible for what ends up on the screen receives support from the way the teacher corrects the hard copy of the story, almost always addressing the writer. As well, there are places on the tapes where helpers disclaimed responsibility. For example, when one writer tried to come up with a title, his helper said: "It's not my problem. It's your, it's your turn."

Further evidence supporting the above formulations of rules for organizing composing efforts will be introduced in the discussion of composing practices.

(b) Level Two

At the level of inputting, the configuration of rights and responsibilities is similar to, yet differs from, level one. On the writer's side, the one difference is that no obligation to input is displayed or enforced. On the helper's side, the right to act is stronger, and more delimited, than at level one. I say that the helper has licence to input in order to convey the idea that, when the helper does input, it is usually under the authority of the writer, who could be said to issue the licence. In that inputting is delegated, it seems that neither side in the relationship feels that the writer should be obligated to input.

The helper's rights at this level seem more closely to flow from the technical ability ascribed to her or him as helper. The helper presumably knows the keyboard better than the writer. This presumption seems true in spite of the differentiation of the instrument of writing into display and executive keys. The writer makes use of the former, while the helper has primary responsibility for the operation of the latter. However, the helper, being at the computer more than the writer (i.e., as both writer and helper), has the opportunity to become more familiar with the display keys. This is doubly the case when the helper is given the licence, repeatedly, to input. The more the helper is licensed to use the display keys, the more reason to let the helper input.

Evidence for the organization of rights and responsibilities at this second level is provided from consideration of practices of student dictionary use. A student dictionary was a blank, lined workbook, with a letter of the alphabet printed at the top of each of twenty-six pages. When students came up with a word they needed to know the spelling of, they took their dictionary to the teacher, who printed the word on the appropriate page. All students in Mrs. Purdy's class had such a dictionary. While there appeared to be much overlap in dictionary entries, there were many differences. Both the writer and the helper would have their dictionaries at the computer centre, thus increasing the number of words at their disposal for use in story inputting.

I say that the helpers and writers displayed an orientation to the licence of the helper because of the way in which dictionary use was organized. With some regularity in my tapes the following pattern emerged. If the owner of the dictionary that had the needed word was the writer, the writer would input while consulting the dictionary, or the writer would dictate the word to the helper, thereby issuing a licence for the helper to input. However, if the owner of the dictionary containing the needed word was the helper, the helper would dictate to the writer, allowing the latter to do what he or she had responsibility for: inputting. The helper might even hand over the dictionary to the writer to use while inputting.

What was least likely to happen was the helper inputting directly from her or his dictionary. In cases where this occurred the writer was occupied with some other task (e.g., talking to the teacher, or going to her or his desk to get something). In one instance where a helper input directly from his own dictionary, the writer authorize the inputting, saying that the helper could go ahead because he had the word, "baseball," in his dictionary. In that the helper commenced inputting before the writer issued his authorization, the instance appears to be a case of the writer "normalizing" what would otherwise be an apparent violation of the preferred order: the helper acting on his own initiative, without licence.

(c) Level Three

At the third level the allocation of responsibility shifts from writer to helper. However, at this level, unlike at the other two, both parties recognize each other's right to act.

As the "expert," the helper has responsibility for seeing that all arranging acts are taken, i.e., that the executive keys are used correctly at the correct point in the text's production. On the Apple II+, using the Write/One program, these are the left arrow key, which achieves deletion of the character to the left of the cursor, the right arrow key, which makes space for the insertion of text, the space bar, the shift key, and the return key.

The cursor movements are not much used during inputting. They require the use of six keys. To move the cursor left, without deleting any character, the shift key must be depressed in tandem with what is usually a display key: left angle-bracket/comma. To move the cursor right one character, the shift key must be used in conjunction with the other bracket key: right angle-bracket/period. To achieve cursor movement up one line, the control key and the T key must be depressed simultaneously. To move the cursor down a line, the control key must be held down while the B key is depressed.

What is most interesting about the differentiation of responsibility for inputting and arranging acts is the way in which this distribution was facilitated by the organization of the hardware and software. This organization, in turn, rendered rational the seating arrangement preferred at the computer. The writer sat, typically, in front of the computer, with the helper seated most often in the chair to the right. Now, note that the executive keys are arranged around the edges of the Apple II+ keyboard like a wide U. By sitting on the right side of the writer, the helper had access to all the executive keys required to run the program and arrange the text, with the exception of the control key, which is at the left side of the keyboard. The writer had easy access to all the keys on the board, and thus was in position to exercise the right to input, and the right to arrange.

Given that both parties have the right to arrange, it is not surprising to find that use of the executive keys was sometimes competitive. Writer and helper in each session of story writing had to resolve the use of the executive keys. Sometimes this was done by the helper announcing what he or she would do next. At other times, the helper simply waited to see what the writer would do after inputting a word. If nothing was done, the helper would hit the space bar. Typically, the helper hit the space bar after inputting a word for the writer. During one story, in the midst of lively debate about what the next word should be, the helper punctuate the debate by hitting the space bar, thereby placing the cursor at the correct location for inputting the next word.

Objective One: Practices

The practices and strategies of collaboration function to make visible and intelligible to interactants what each is doing, in relation to the task. Recall that at the computer, writing is talk. The practices of interest, thus, turn out to be discourse practices. The practices can be sorted as composing practices, inputting practices, and arranging practices.

(a) Composing Practices

Three practices are noteworthy here: candidacy, cloze, and oral reading. The candidacy practice consists of the writer taking a turn at talk that occupies itself with generating candidate text. The practice can be initiated at the beginning of a story, or after the inputting of any sentence. Its concerned is to produce a story part. A "story part" is a sentence, or what could be the initial part of a sentence, such as "We can play::". In this example the final vowel is elongated, signifying that the story part, as a sentence, is not complete. The candidate may or may not be input in its incomplete-sentence form. Other candidates may be offered, with the helper furnishing candidates too. But the helper usually only formulates candidates after the writer has demonstrated the form of the story part he or she is considering using/inputting.

The use of this candidacy practice, as initiated by the writer, can occasion the use of a cloze-like practice by the helper. Persons familiar with devices for measuring reading comprehension will no doubt recognize a relative of this practice in collaborative writing. In tests of reading comprehension, students are given passages of text that paraphrase, or in some way formulate a passage that the student has been assigned to read. In the measurement passage blanks appear in the text. The student must "cloze" the sentence by filling in the blank. How the student fills in the blank is treated as evidence of the student's comprehension of the assigned passage. Such a cloze sentence might read: "Silver Cloud helped his mother make maple _____."

In collaborative composition, the writer produces a candidate story part that is hearable as an incomplete sentence. The helper tries to "fill in the blank" by offering a candidate cloze part. For example, the writer issues the candidate story part: "The sun is::", where the final consonant is elongated. The helper offers "hot" as a candidate cloze part. The writer need not accept the part, and may issue one of her or his own.

What is most interesting about the candidacy practice and the cloze practice is their "offered" character. The candidate is a tentative part of the story, but tentative parts need not be voiced. When they are voiced, they are hearable as candidates. Since the writer has the right to input whatever he or she desires, the voicing of a possible story part marks that part as only a candidate. It announces what may be input next. It tells the helper where the story might go. Since the writer does not have to voice candidates, the decision to do so could be a display of a concern for helper approval, or at least tolerance, of the writer's candidate story part. Even though the helper's right to compose is only an incidental privilege, the writer's voicing of candidate story parts both offers and validates that privilege.

The fact that the helper offers candidate cloze parts entails recognition of the writer's responsibility for what is composed. In that the writer is taken as the person having the final say on what will become the story, the helper's offered cloze parts necessarily have only a candidate status. The offering of cloze parts displays to the writer that the helper is attentive to the task at hand, composing. Further, it displays that the helper has a sense of the writer's projected direction for the story. Both the writer's and the helper's practices are important for how they convey and display orientation to the task of producing story parts--sentences--authorized, if not fully authored by, the writer.

The third practice is oral reading. Rather often during the course of a writing session, the story on the screen will be read aloud by the writer, or the helper, or by both students. The reading is sometimes accompanied by one or both students running a finger under the word as it is pronounced. The practice no doubt has uses and effects that observers cannot recover. As mature writers will sometimes read their text to see how it sounds, or to get a "running start" to break through a problem in deciding what should be said next, the practice could have similar functions for students.

What can be said about the practice, though, is that it seems to work as a device for collecting attention and directing it to what has been input so far. The practice has an obvious composition function when the text read is incomplete. While the text's sentences may be deficient in syntactical ways that render them incomplete for a mature reader, what counts as incompleteness in the setting is a sentence that does not have a period. The absence of a period occasions work to produce text that would make it appropriate, in the view of the writer and helper, to place a period. As students were meticulous in putting in periods, the work of producing further text typically was addressed toward the last story part on the screen.

When the oral reading practice was used on incomplete story parts it operated in a way similar to the candidacy practice. It occasioned the offering of candidate cloze parts. Such parts were often produced in the discourse as if they were a continuation of what appeared on the screen. For example, where the screen might display: "She is printing", the writer would read aloud "She is printing", and the helper would chime in, completing the sentence with a candidate cloze part: "her story."

Through the candidacy, cloze, and oral reading practices the writers met their responsibility and obligation to compose, while allowing helpers to collaborate in more than just a technical capacity. Even though the mandate of the helper was limited to offering support needed for the writer to write, the three practices outlined here were widespread. Thus, on any story produced with a helper, the writer and helper operated as "senior" and "junior" author, respectively.

(b) Inputting Practices

Inputting practices consisted of verbalizing, searching, and checking. The practices were linked, and can be analysed to have a number of functions, both interactional and performative.

Verbalizing took two different forms, having different apparent functions. If one person verbalized the letters to be input, while another person did the inputting, the function was interactional, in the sense of communicating information. This verbalizing was like dictation. The method of dictation was one letter of a word at a time. The dictator would say the letter, then wait for the other person to input the letter. The dictator would then say the next letter, and wait for it to be input, and so on, until the entire word had been input. I observed no cases of a student dictating an entire word, or a sequence of letters, without timing the delivery of the dictation to alternate with inputting. If dictation was interrupted, the dictator typically would reinitiate the dictation from the beginning of the word. The dictator did not depend on the person inputting to remember what had been dictated before the interruption. Reinitiating the dictation, after the interruption, from the beginning of the word solved the problem of "where are we now?"

Dictating may or may not be combined with a checking practice. If it was, the dictator pronounced the letter, while looking at the word in a dictionary, then watched the video

screen to check whether the letter displayed on the screen was the one just uttered. If it was not, the dictator engaged in repair practices (cf. Schegloff, Jefferson, and Sacks 1977), gasping, or saying something like "No," which brought a quick response from the inputter, who would correct the error.

In the second form of the verbalizing practice, the person inputting verbalized what was input. As noted before, the temporal relation between inputting and verbalizing varied. Verbalizing usually preceded or coincided with depressing a key. The function may be interpreted as interactional in two ways. It obviously lets the other person know where the inputter is in the inputting process. This is a trivial function, in that the other person can observe the video screen, or watch the inputting itself.

The other interactional function of verbalizing is more subtle, and consequential. To appreciate the function, it is important to note that, while the inputting is occurring, the other person does not speak, or at least does not speak to the person inputting. This simply may be a courtesy extended to the inputter, but I conjecture that the silence occurs on the part of the other person because the inputter verbalizes what is being input. The inputter takes a turn at talk, and thus can be oriented to as having the floor for the duration of the turn. If verbalizing holds the floor, it prevents other demands from being made on the inputter, e.g., to compose. Verbalizing assures interactional "space" for inputting to be done. When it ends, the floor is again open for the taking. If this conjecture is true, it does not much matter whether the verbalizing precedes, conicides with, or follows each strike of a key: the floor will still be held. The inputter will have some protection against competing demands on her or his processing capabilities and time.

There is a second possible function of verbalizing, a function that aids task performance. Verbalizing the letter while looking at it on the page of the dictionary loads the sound of the letter into auditory memory. With the letter in both visual and auditory memory, the inputter has a better chance of remembering what letter needs to be found during the search of the keyboard. During this search, more information is being introduced into short term visual memory from the keyboard, perhaps making it more difficult to succeed if memory of the letter is only visual.

Inputter verbalizing can be organized in real time in conjunction with the operation of the two other inputting practices, searching and checking. The inputter who uses a searching practice to find a key usually verbalizes the letter prior to depressing the key. Or, the verbalizing will be an accompaniment to the search, with the letter being repeated, or sounded in an elongated form.

In calling searching a practice, I am making reference to something having the character of a strategy, or at least a tactic. I observed the same students in October of 1984, at the beginning of their year in Grade 1. At that time they were running through Write/One's keyboard familiarization programs. These programs require the student to find and depress the key having the letter presented on the screen. At that time I observed the use of strategies that some students seem to have carried over in their videotaped writing efforts, at the end of Grade 1.

The one strategy worth noting was the one used by the students whose response time was the fastest, and who seemed to experience the least amount of frustration. Those who did not use this strategy just let their eyes roam over the terrain of the keyboard. Those who did use the strategy roamed the terrain with their finger; that is, the strategy involved moving a finger over the keys, using the finger as a pointer. The movement of the finger was not random. Instead, it was remarkably consistent between students in the path it covered. The student would usually begin with the finger at the left side of the bottom row, and sweep to the right along that row. At the right end of the row, the finger would move up a row and sweep left, then up a row and sweep right. There were variations in how this strategy was carried out, but it assured that most of the keyboard's terrain would be searched, resulting in the letter being found. If it was not found, the strategy was repeated.

Some students used this strategy to search for letters while inputting during story writing. It seem to come into play when the letter was one not used repeatedly in their stories. The student who was most frequently asked to be a helper was the student who used this practice most, and most efficiently, when the needed key was not quickly sighted.

The other practice used with verbalizing was checking. We have noted that dictators can check what is input. Persons inputting from dictation can, and do, check as well. Consistent with the character of inputting from dictation, they typically check each letter after it has been input. Persons who are inputting directly seem to check after each letter is input, or not until the entire word is input. The choice of when to check makes a difference to how long it takes to input a word. Checking after each letter means that inputting takes longer, but it assures that what is displayed on the screen corresponds to the keys depressed; whereas checking after inputting makes the process faster, but less safe from error.

If the inputting is from dictation, checking on a letter-by-letter basis may be preferred, as the dictator may be checking the screen, too. Again, the presence of another person may have consequences for how the writer or helper behaves. In this case, the issue

looks to be a moral one. The concern would be a loss of face with the other person if one is seen to make an error. Since the students were quick to point out errors, moral issues look to be lively concerns for them.

With the practices of inputting, we see that both writer and helper can be involved, even though only one of them does the actual pressing of display keys. This is clearest in the case of the two forms of the verbalizing practice. It can be true during the use of the checking practice, since both persons are free to check the screen. The searching practice seems to be the only one that is carried out by a single person. But even in the case of this practice, the presence of the other person can make a difference.

During the search, the writer seems to regard the helper's presence as a pressure. A letter must be input before the next collaborative action can occur, so there is pressure of the sense of the other person waiting for inputting to be done. Secondly, there is the very real possibility that the other person will invade the terrain of the keyboard to "help" in the search, or to take over the search if it seems not to be succeeding. Since helpers typically know the keyboard better than the writer, they are often ready to take over. It was not unusual to see a writer push away the invading hand of a helper (see appendix 4, middle picture). On the other side, the writer may assert responsibility for inputting, taking over, or putting pressure on the helper to get the job done.

While only one person is inputting at a time, both are involved, through the exercise of the above practices.

(c) Arranging Practices

Interestingly enough, arranging was the least collaborative of the three types of writing acts. Of course, arranging depends on there being something composed and input. However, the acts of using the executive keys were themselves rarely done collaboratively.

Recall that both writer and helper exercised the right to arrange the text. Arranging differs from inputting and composing acts in that neither interactant's right is stronger than the other's. The only difference is that the helper is taken to have responsibility to see that arranging is done. Occasionally, but rather less often than the teacher would have liked, the helper instructed the writer as to what should be done, by way of arranging. When such instruction happens, as when a helper says to the writer: "put a space", arranging can be spoken of as collaborative.

Under the general heading of arranging, some types of interaction should be mentioned. If we understand arranging to be concerned with control, then it is not stretching usage too far if we consider interaction that was prevalent and concerned with control.

At some point during the production of most stories, issues of control arose. The primary form had to do with seating at the computer. The students vied to use what I call the "driver's seat",[2] directly in front of the computer. This was the seat from which it was easiest to use all the keys on the keyboard, and, therefore, the best seat from which to control access to the keyboard. The computer centre always had a second seat, placed to the right of the driver's seat (see appendix 4, top picture). Occasionally, the centre had a third seat, placed to the left of the driver's seat.

No matter whose turn it was to be the writer, whoever got to the computer centre first would slide into the driver's seat. At the arrival of the designated writer, the helper would usually move over to the right side seat. Often the helper would sit on the left edge of the right side seat, almost sitting on the right edge of the driver's seat.

When the writer would get up, to have the teacher put a word in her or his dictionary, or to leave the centre for whatever reason, the helper would sometimes slide into the driver's seat. On the writer's return, the helper usually would move back to the right side seat.

With some regularity, disputes arose as to where persons had a right to sit. At that point, they would formulate to each other what the rules for seating were. Often the solution came about by one student seeking to have the teacher ratify her or his version of the rules.

Such disputes would sometimes arise because of the presence of three chairs, but only two students. When there were three chairs, the left chair tended to overlap the space normally taken by the driver's chair. Confusion would arise if the writer took the left chair and tried to "drive" from it, with the helper too well positioned for the writer to resist invasions of display key terrain. Or trouble would arise if the helper sat on the left side chair. Use of the delete key, which I consider an executive key, required the helper to cross the display key terrain. This in itself became a problem only when the writer was engaged in inputting.

As the above already makes evident, access to, and use of, the keyboard was at times a contentious issue. The writer faced the most trouble when there were two helpers, one on each side. In such terrain disputes, which were mainly inputting and punctuation disputes, there was occasional grabbing of the other person's hand. The other person's hand would be lifted from a key, shoved away, held immobile, or sometimes directed to a specific key.

When the teacher, Mrs. Purdy, used the Write/One program at the second grade level, she voiced and reiterated a rule that helpers were not to touch the keyboard. But at the first grade level, where students had less experience writing and found arranging text to be difficult, she found it necessary to allow helpers to touch and use the keys. While a system of enforceable expectations was invoked and used to organize and control access to the computer, circumstances occasionally arose where the expectations were unsuccessfully enforced, or were deemed somehow inappropriate.

What these "computer struggles" reveal is the importance to students of control over the text production process. The practices of composing and inputting, and the practice of teaching arranging, all presuppose and provide elegant solutions to the problem of who will control what happens next, given certain enforceable expectations about rights and responsibilities. The problem of control is twinborn with the essential problem interactants face of communicating to each other what they are doing, and what needs to be done. Thus the problem of control is endemic to collaboration. It is easier to arrange text than it is to arrange collaboration. Fortunately, the students in this study were ingenious at accomplishing both.

Objective Two

The second objective of the research is to formulate the advantages and disadvantages of allowing students to be helpers during writing at the word processor. Of course, the bases for such formulations are limited. Only three weeks, at the end of a school year, were spent in a Grade 1 classroom. Not all students were observed and videotaped. Fortunately, the teacher acted as a consultant to this research. Still, the sample of collaborative word processing is small. On the other hand, Mrs. Purdy is an innovator in this field: there has not been that much collaborative word processing done, or reported on, especially at the Grade 1 level. The area of research, and the pedagogy studied, are both so new as to make it premature to speak decisively about advantages and disadvantages.

Even further caveats are in order. There are no advantages or disadvantages that are context-free. There are advantages and disadvantages to allowing collaboration under different circumstances, depending on the goals and values of the teacher. Depending on one's theory of writing and writing development, the conceptions of advantages and disadvantages

will vary. Finally, what I have observed, recorded, and analysed is only one type of writing task organization, geared to one type of writing: narrative. The task organization could be described as minimally structured. Topics were not given to students, and few constraints were laid down regarding how the task ought to be approached, or how it ought to be carried out. There are other task organizations conceivable, though we cannot know how viable any of them might be at the Grade 1 level.

An obvious difficulty in assessing this study is establishing a benchmark against which to measure advantages and disadvantages. To achieve an assessment in which we would have more justified confidence, it would be necessary to carry out research in at least one classroom, observing writing under four different conditions, involving a variation of medium of expression and number of persons:

1. one person, using pencil/pen and paper;
2. more than one person, using pencils/pens and paper;
3. one person, using a computer;
4. more than one person, using a computer.

The present research examined only condition 4. In the absence of systematic observation of the other three conditions, I have had to rely on extrapolation from cognitive psychology literature on writing, and have depended on the observations of Mrs. Purdy.

The discussion of advantages and disadvantages is organized as follows. First, a few remarks will be offered on general advantages of using computers and allowing collaboration. Then, from a perspective concerned solely with writing skills development, we will consider the pros and the cons of using helpers during word processing sessions. Finally, we shall consider the apparent wisdom of utilizing helpers under conditions where fluency in language use is a primary objective.

General Advantages

The use of computers for word processing in schools has been hailed as a major breakthrough for writing pedagogy (e.g., Sivin et al. 1984), while researchers have tried to assess their actual value (Kane 1983; Miller 1984). Advantages usually noted are that

students are not faced with the problems of controlling recalcitrant pencils, striking out copy that they would prefer to be flawless, and being unable to read their own writing. Researchers have only begun to study the effects of computer use on writing skill acquisition; hence, it is difficult to sort out those effects from effects achieved through collaboration during word processing. There are some general advantages, though, that should be mentioned.

First, there is the argument that children learn better in small group settings. Work on computer assisted learning suggests that students working in pairs can learn as much as, and possibly more than, students working alone (Golton 1975; Okey and Majer 1976; Sutter and Reid 1969). However, such studies did not concern themselves with learning to write using a word processing program.

Secondly, it is obvious that allowing two students to work at the computer doubles the use of a scarce resource. Given that there are still not that many computers in classrooms at the Primary level, collaboration seems to be a way of compensating for the shortage of equipment. This presupposes, though, that collaboration is a good thing in itself. Following the logic of this economic argument, it would be even more sensible to have three students collaborate, or four. This logic presupposes that we know the difference that adding more helpers makes, and that the difference is beneficial.

Thus, a consideration of the general advantages of collaboration does not lead to a recommendation for allowing student helpers. Instead, the recommendation is for a closer look at what the advantages and disadvantages might be of utilizing helpers.

Collaborative Practices: Benefits and Impediments

The strongest basis for saying anything regarding advantages of collaboration for writing skill acquisition is to be found in a consideration of the practices of writing that this report has described. Since only the composing and inputting practices were recurrently collaborative, we will not be concerned with arranging practices except to point out their obvious benefit.

The reason for institutionalizing the helper position in the first place is that most students at the Grade 1 level had difficulty, at least initially, learning and remembering how to control the production of text through the use of executive keys. To the degree that students at the early Primary level have this difficulty, the utilization of a helper is an

obvious and important advantage over the teacher having to act as helper to each child at the computer. If the computer is to be used for word processing in Grade 1, it seems wise and virtually necessary to use students as helpers, at least initially.

During my observations in May, there were still some students who needed technical help. It would be possible to continue the use of helpers only for those students who require aid in arranging the text and moving the cursor. However, none of the student helpers limited their aid to text formatting or cursor control. Given that all helpers were involved in composing and inputting, consideration of advantages is most realistic if it addresses the value of collaboration in those phases of writing at the computer.

(a) Composing: Candidacy Practice

The major advantages of the collaborations that I witnessed derive from the composing practice of offering candidate story parts. The uttering of story parts as candidates for the text is important because these candidates stand midway between the private thoughts of the speaker and the public, reviewable electronic text. In this midway, candidate sentences can be heard by the other student, and by any other person present at the time. In the circumstances of speech in the presence of a hearer (cf. Heap 1984), candidate story parts have a further interesting feature. They can be listened to by the speaker for how they will be heard by the hearer. This seems extremely important, or at least promising, from a cognitive perspective.

In his work on the development of literacy, Olson (1977) has argued that there is a difference between what a speaker means, and what a text means. If this is true, in some form, then learning to write requires learning to appreciate this difference. It requires being able to develop an appreciation of "how the text reads" as opposed to "how I wrote it." In the words of Bereiter and Scardamalia (1982, p. 3), "Learning to act as a reader of one's own text and learning to overcome the saliency of what one has already written appear to be major steps in developing a language production system that can operate flexibly with feedback from its own input."

While it is clear that the first grade students in my study did not appreciate the difference between utterance and text (Olson 1977), the uttering of candidates during collaboration (and as collaboration) may direct students down the path to appreciation.

In orienting to how candidate story parts sound, and how they could be heard, speakers can begin to distance themselves from their thoughts. The thoughts, as language, can become, indeed are, objects of reflection and evaluation. Recall that speakers, who are usually writers, seem to display a concern for helper acknowledgment, tolerance, or acceptance of offered candidates. Learning to orient to how a candidate sounds, using whatever criteria students may employ, puts one on a path to understanding language, whether oral or written, as something that one can reflect on, and evaluate. Learning to take such a metacognitive perspective is essential to developing a sense of audience for one's writing.

Concretely, the helper is, to some degree, the audience oriented to during composing. Of course, this audience is a visible hearer, unlike the invisible reader. In this regard, though, the competence requried of, and finely honed by, some speakers, to design utterances specifically for who they take their audience to be (cf. Sacks, Schegloff, and Jefferson 1974; Heap 1984), can be transformed into a competence for designing "written speech" (i.e., text) appropriate to an intended, or expected, audience. Since the speech that is written at the computer is first offered as a candidate, hearable by a helper, the conversational turns that offer candidates would seem to stand in the midway of a path from naturally occurring conversation to coherent composition. This is a path that Bereiter and Scardamalia (1982) argue must be traversed.

While the instances were rare, the videotapes caught strips of interaction where offered candidates were taken up in ways that should have reinforced speaker orientation to how the candidate story part could be heard. In one session, the writer was trying out candidates for a story titled "It's Spring." He said "In Spring we can...go swimming." His partner immediately came back saying, "No, the beaches are closed," which is true in the Toronto area. The writer responded, "Oh yeah." As with other young writers, there was the concern with the veridicality of claims in stories, but we also see here how a helper can disagree with the writer, and thereby defeat a candidate.

In another story, called "At the Zoo," the writer offered the candidate "Then we saw feets." The surprised helper uttered: "Feets? What are feets?" This challenge led to a discussion, which involved the teacher, sitting at her desk just feet away from the computer centre. It turned out that the writer wanted to tell about the animal footprints that are used at the Toronto Zoo to mark the paths to the animals that make those prints.

In both these examples we find the helper acting as a competent member of our culture, a competent language user. In so doing, the helpers were acting as enforcers of community standards as to what is sensible and intelligible to say, and, hence, what is sensible and

intelligible to write. In this way, the use of the candidacy practice, for publicizing potential story parts, seems to be a resource for reinforcing writer orientation to how her or his talk sounds. If this is true, this practice may be a resource for bringing students to appreciate how a text can be read.

Closely tied to the value of candidate offerings as being midway between conversation and composition, is the notion that the presence of the other, as a hearer and possible evaluator, may pressure the writer into developing skills of self-regulation in writing. Scardamalia and Bereiter (1980, p. 5) have noted that the composing behaviour of expert writers may be distinguished from those of novices "by the greater frequency of use of regulatory mechanisms compared to the use of nonregulatory mechanisms such as generating [ideas] and transcribing." These regulatory mechanisms are ones that treat the text as an object, as when checking, planning, monitoring, revising, or evaluating a story.

Examined with a concern for facilitating writer self-regulation, the candidacy practice again looks promising, virtually for the same reasons as before, but with one additional feature. The collaborator can aid in facilitating writer self-regulation by evaluating candidates. That helpers will evaluate candidates seems known by writers. In sociological terms, this fact, as something oriented to as a fact in the writing setting, can be experienced by writers as a moral concern. Their identity and value are on the line.

To err is human, but it entails a loss of face when the error is made in public (cf. Goffman 1971). It is my conjecture that the presence of the other, the helper, can be experienced as a pressure to produce and offer candidates that have a chance of being accepted, or at least tolerated, by the helper. This pressure could lead writers to monitor and evaluate their own candidates as they are generated. The anticipated evaluative responses of helpers could aid writers to become more self-regulative.

(b) Composing: Cloze Practice

The benefits of the cloze practice for acquiring writing skills is less clear cut. Indeed, there is reason to argue that the practice may be an impediment to acquiring the higher level skills of composing that mark mature writing.

The cloze practice of filling in the "blank" in a candidate story part, or the "blank" at the end of an incomplete sentence on the screen, is what Bereiter and Scradamalia

(forthcoming) could call a cognitive coping strategy. It differs from other such strategies studied by psychologists in that it is a strategy used by two persons, or more. It is a practice that helps collaborators cope with the problem of having to bring forth something to go on the screen. The problem is usually solved by Primary level writers, and some Junior level writers as well, through "knowledge telling." The writer simply works to tell all he or she can think of (i.e., knows) about some topic. The result is a text having an additive character, as if the author has just listed whatever came to mind.

While Bereiter and Scardamalia's work has been with students from the fourth grade up writing expository texts, the use of the knowledge telling procedure is evident in the narrative texts produced by the students that I observed. That procedure encompasses, but is not exhausted by, what I have called the cloze practice. Some stories became dependent on the practice, using candidates that were just variations on one sentence model. For example, in a number of zoo stories, the model was "We went to _____," with a few variations (e.g., "And we went to _____," and "Then we went to _____"). Or, "We saw the _____," with variations beginning with "And" and "Then."

What is troublesome to Bereiter and Scardamalia about the knowledge telling practice is that it produces a text, but it is not a text with the sort of structure and topical development we require of good writing. The strategy produces a list of sentences that do not combine in ways that reflect the effort to follow a plan, or to achieve a goal in writing. That such lists of sentences can pass for writing stands as an impediment to the development of writing skills, at least in the higher grades.

In Grade 1, however, there is a real question as to whether students would be capable of writing without engaging in knowledge telling. Even if the teacher, or a cognitive psychologist, acted as helper to each student, and pushed students to exercise higher level skills, there is no evidence that any such interventions could lead Grade 1 students to drop the use of knowledge telling strategies.

Indeed, it may be the case that knowledge telling strategies, at the early Primary level, are beneficial. They are devices that allow students to play with language, to experiment with what it can do, and with what they can do, to represent their experiences, beliefs, and feelings in a new form: as text.

If knowledge telling strategies do have benefits at this level, then the cloze practice is beneficial. It allows students to explore language. I shall return to this theme.

(c) Composing: Oral Reading Practice

The oral reading practice may have benefits for appreciating the text as an object, as something that can be read. Oral reading shows how the text sounds when read. The practice of rereading the text may account for the relative absence of what sometimes appears as a problem at the early Primary level. It has been noted (Ministry of Education 1975, p. 57) that children have considerable difficulty in identifying sentences and putting periods in the right places.

During my observations, period placement rarely was a problem. When the issue arose, one of the students at the computer centre, or one of the students following the story on the large monitor, would know where to place the period. Further, a review of the teacher's corrections to stories written on the computer during May revealed no corrections of period placement. The only related errors were failures to place a space after the period, before the next sentence. The teacher, however, did not correct these errors, as she felt that students had enough to learn and worry about as it was. In her previous use of Write/One at the Grade 2 level, though, placing spaces after periods was taught, and errors were corrected.

It is my conjecture that the practice of oral reading aided students in coming to be able to identify what counts as a sentence. The sounding out of the text turns it into talk, and students know how to talk. However, speaking against this conjecture is the fact that students did not "read with expression." It would be rare to find a first grader who was able to do this. Students' oral reading from the screen, though, did display different intonational contours, befitting the syntax used in the text.

There is reason to believe that students writing at computers should have fewer problems with punctuation. Punctuation signs appear on the keys of the computer. They are seen when students search the board for letters. When handwriting at the writing centre, students do not have these reminders repeatedly in their visual field.

It might be thought that the oral reading practice, and its benefits, attend to any writing, and not just to collaborative writing at the computer. This is correct, but I suspect that the benefits are reaped more often during collaborative word processing, for two reasons. First, the computer provides an easily readable display of what has been written (Purdy 1981; Levin et al, 1984; Dickinson 1985). This should facilitate reading the text. I would expect to find more oral reading at the computer than at the writing centre. Secondly, I did observe oral reading during solo writing, but in those cases where a student joined a

writer "mid-stream" as a helper, the amount of oral reading increased noticeably. This may be tied to the fact that oral reading is a way of writer and helper displaying to each other where they are, and where they ought to be, so as to synchronize their collaborative efforts. While the oral reading practice is useable under a variety of writing conditions, collaborative writing at the computer may well be the condition that best facilitates oral reading, and that gives further reason for using the oral reading practice.

There is one further benefit of the oral reading practice. If composing is a process where "mental representations are continually being reconstituted" (Scardamalia, Bereiter, and Goelman 1982), then there is a problem of recalling just which representations have been committed to text. Given that thought about the text during composing is mixed with what one has said, and with what one has heard the collaborator say, there may well be more problems during collaborative writing than solo writing with recalling just what has been written. Joint oral reading of the text "refreshes" the memory of the writer and the helper at the same time. This sharing of the text in memory should be useful for deciding "what next". This is one more reason why oral reading may be done more during colloborative writing.

(d) Inputting: Verbalizing, Searching, and Checking

During inputting, in both its collaborative and solo modes, the practices of verbalizing, searching, and checking all reinforce knowledge of spelling. Because there is a keyboard topped with graphemes, the use of the computer introduces a level of cognitive processing not found in the use of pencils and pens. Collaboration may increase the benefits of word processing because it can distribute these processing tasks differently than in solo writing. The assumption here is that breaking down and sharing cognitive tasks can reinforce learning in a way that performing the whole task may not.

The two forms of the verbalizing practice, inputter verbalization and dictation, both share the same benefits, though the benefits are differently distributed. The benefits shared by both have to do with learning spelling. By decoding from a grapheme-on-a-page to a phoneme, then recoding to a grapheme-on-a-key, the inputter has the opportunity to see, hear, and "do" the spelling of a word.

When inputting is done collaboratively, both students have an opportunity to learn the spelling of the word. The dictator "reads" the letter, decoding from grapheme to phoneme.

The inputter hears the phoneme, and, without the visual image stored in short-term memory, has to access long-term memory to recover the corresponding grapheme. Unlike at the writing centre, the problem is not to represent the recovered grapheme, but to match a grapheme-on-a-key to the memorially recovered grapheme. In principle, it would be possible for the inputter to search the keys upon hearing the phoneme, and to decode the graphemes on the keyboard in order to arrive at a match to what the dictator has uttered. This likely would be a less efficient strategy. I am unable, of course, to decide from videotapes what strategy was used, or when any particular one was used, but both are culturally possible.

Whichever strategy is used, the inputter who takes dictation has to do more memory searching than the solo writer who uses a dictionary. This extra searching and activation of knowledge should aid the student in learning the spelling of the target word, perhaps more quickly than the solo writer would learn the word.

When the dictation form of verbalization is combined with the screen checking practice by the dictator, there is the possibility of further benefit for the dictator in learning the spelling. The dictator has to see whether what he or she decoded to sound was correctly recoded. In that a "correct match" will be a match between a letter printed by the teacher, and a letter displayed by activation of pixels on the screen, the dictator has to recognize "identity through difference" (cf. Heidegger 1969). In using the checking practice, the dictator has to activate additional knowledge and engage in a further cognitive procedure, thus increasing the possibility that the spelling of the word will be remembered.

General Disadvantages

There are a number of disadvantages to using student helpers, some of which emerged during my observations, and others of which were pointed out by the teacher based on her experience over the past three years. Some of these disadvantages arise from circumstances and structures that can be altered.

(a) Dependence and Workload

The obvious problem with student helpers is that writers can become too dependent on

them, such that they do not bother to learn the arranging functions of the software as these are achieved through the computer's (program dependent) executive keys. This problem is most likely to arise when the helpers do not easily allow writers to exert their right to arrange the text. This situation arose during the editing phase of some writing sessions, where the writer and helper would sit down at the computer with the hard copy of the story that the teacher had just corrected with them.

To edit, some helpers would move into the "driver's seat," with the writer becoming little more than a witness to the helper's editing efforts. One reason that this happened, I sense, is that editing requires cursor movement up and down on the screen. As mentioned in Part 1, on an Apple II+ using Write/One, the control key must be depressed in tandem with the T (for top) or B (for bottom) keys. Holding down the control key, while sitting in the right-side helper's chair, requires a student to reach across the keyboard, in front of the writer. Since editing requires using the display keys (T and B) for executive functions, as well as the executive keys on both sides of the keyboard, it is easier to edit from the "driver's seat."

When the teacher noted the helper doing the driving, she exorted the helper to show the writer how to edit. Indeed, the way to overcome this alienation of the writer's right to arrange text seems to be to make salient to the helper the need and obligation to instruct the writer on how to do what the helper supposedly knows best: how to arrange text.

The helpers who know arranging best run the risk of being selected often to be the helper. This is a risk because they can end up falling behind in their own work. This tended to happen with the most popular helper in Mrs. Purdy's class. The way in which the problem was handled was through making known, and enforcing a rule: "you can't help if you don't have your own work done." At the point when students would offer to help, and some child was chosen, the teacher would intervene if she suspected that the chosen child had her or his own work to finish. Intervention was done by invoking the rule and asking the student about the state of her or his work.

Mrs. Purdy tries to alleviate the problem of helper workload by creating a pool of students to be helpers. Her efforts require balancing the consequences of two perceived facts: some students are better than most of the others at using the hardware and software for word processing; most students will be better at using the computer than those few students for whom writing and the use of the computer are difficult and frustrating. The first fact leads to pressure to be helpers on those who are thought to be the best at using the

computer. They do not have to bid; they are just chosen by writers. The second fact presents an opportunity for students who do not know the hardware and software better than most of their cohort, to nonetheless function as a helper to students who know the computer even less well.

The problem is how to involve the latter students as helpers, and to retain the system the children seem to like and value: choosing their own helper. No doubt there are a number of solutions to this problem. Mrs. Purdy's rule about completing one's work as a prerequisite for helping others has useful consequences in these circumstances. The most used helpers typically will reach a point where their own work is not being done on schedule. This drops them from the pool. At the point where the teacher intervenes to check if the popular, chosen helper has completed her or his work, it is possible for the teacher to suggest that the writer work with another student. This allows the teacher to match the helper to the writer while allowing the writer first choice. To the degree that the most popular student is the first choice, the teacher is assured of having leeway to match writer and helper.

(b) Off-Task Behaviour

As in the classroom that Dickinson observed, there was a fair amount of "off-task behaviour" during collaborative writing sessions. However, "off-task behaviour" is a troublesome category from an ethnomethodological perspective. Only in retrospect, from an analyst's standpoint, can some behaviour be coded as "off-task." When apparent off-task behaviour is initiated at the computer, it cannot be known if it will turn out to be codeable as off-task. There is always the possibility that the behaviour will turn to, or be turned into, something topically relevant to collaborative composing efforts.

The coding of behaviour into on-task and off-task categories requires judgements about how, and whether, each observed behaviour is relevant to the task at hand. Off-task behaviour is worth knowing about because it is assumed to be dysfunctional for task completion. But the quantification of such behaviour during any writing session treats all such behaviour as equally dysfunctional, while some of it may be functional for related tasks, or for a later performance of the same task, e.g., using the computer to write a story.

In my tapes there are "off-task behaviours" that consist of helpers showing writers "tricks" at the computer, at a time when those tricks have no application for the current

task. The tricks include demonstrating how to save a story and return to the story, without the story being altered in any way. Another trick involves hiding the cursor on the screen. Based on experience teaching novice adult users how to operate computers and run software, I regard such "off-task" trick demonstrations as possibly important for users' development of cognitive models of how hardware and software work. In solo computer use, models are built through trial and error (even when following a manual). In collaborative computer use, such models can be built through trials, without error.

A sensible retort is that we may wish to distinguish between types of off-task behaviour. Then we must solve the problem of detecting and measuring off-task behaviour in solo writing, compared to the amount found in collaborative writing. The problems of detecting and distinguishing types of off-task behaviour are exacerbated by our presence as researchers. The presence of researchers, with videocamera and/or microphone and tapedeck can occasion off-task types of behaviour. But we cannot tell if our presence occasions more off-task behaviour than when no researcher is present, because we need a researcher present to note and record such behaviour in the first place. (And if we place ourselves and our equipment behind a one-way mirror, how do we know that the students do not assume someone is behind the mirror, or do not engage in antics because they can see themselves in our mirror?)

Research must be done, as Dickinson has initiated, on the organization of "off-task behaviour" during collaboration and solo writing. Until that work is further along, it is difficult to grasp the consequences, and uses, of such behaviour.

(c) Intrusions

One obvious disadvantage of having a helper present is that the helper may intrude upon the writer's composing efforts. Given that the turn distribution system for talking is based on speaker self-selection (cf. Sacks, Schegloff, and Jefferson 1974), the helper can select to speak at any time. I believe that this possibility drives the use of the candidacy practice and the practice of inputter verbalizing. Both practices give the speaker the floor, saving the speaker, to some degree, from intrusions by the other student.

However, there is a downside to using these practices in just the circumstances where they are most needed: with another student present. If the practices assure the speaker of the floor, they also assure that what is said, and thus what is "thought out loud" during

composing, will be hearable by the other student. This provides for the possibility of the other student, usually the helper, engaging in a class of actions conversation analysts call "repairs" (Schegloff, Jefferson, and Sacks 1977). This class includes challenges to writer candidate story parts, and corrections that are done on inputting, e.g., spelling. In the parlance of sociology, the likelihood of repairs being offered by helpers puts pressure on the "face" of the speaker/writer. The writer speaks, perhaps, to have the floor, but in having it must face the fact that her or his actions will be scrutinized by the helper. This could put constraints on what the writer will propose as story parts, depending on the type of person the helper is taken to be: tolerant, tough, sweet, smart, dumb, easy-going, critical, assertive, pushy, persnickety, etc.

Repairs of inputting, in the form of corrections by the helpers, may lead to an over-emphasis on correctness of spelling. In Education in the Primary and Junior Divisions there is concern expressed over spelling and punctuation correction as inhibiting the writer's willingness to write (Ministry of Education 1975, p. 52). It is recommended that the teacher refrain from immediately correcting errors (p. 57). However, in my tapes, the concern with correct spelling is not manifest primarily after the word is written/input. The concern is to get the spelling right in the first place.

The children made little use of invented spelling. Instead, they consulted each other's dictionary, and, if needed, turned to the teacher for the spelling of a word. That they consulted both dictionaries, though, brings out how the presence of the helper can be an advantage: the teacher is saved from having to print as many words during a writing session. Indeed, so-called solo writing that I observed, often treated the teacher as a spelling helper, making the solo effort a form of collaborative writing after all.

Once the students have produced a draft of the writer's story, they print it and take the hard copy to the teacher for reading, correction, and feedback. The marking of spelling errors may reinforce the student's concern with correctness. This may be regarded as untoward from the perspective of the Ministry's 1975 policy guidelines. However, correction on the computer serves a different function than correction of handwritten copy. The handwritten copy would have to be retranscribed, or just left marked up with the corrections. At the computer, though, correction requires cursor movement and use of the deletion and insertion keys, i.e., use of the executive keys to arrange text on the screen. Editing from the corrected hard copy provides an opportunity for the writer to learn how to use the executive keys on a task and text of some importance to her or him. If the helper, though, just does

the editing, without trying to instruct the writer, then such "collaboration" during the editing phase may well reinforce dependence on the helper and inhibit the development of writer autonomy. Of course, the issue here is not collaboration's disadvantages, but rather how collaboration ought to be organized by the teacher. Left to their own devices, students will evidence a variety of helping styles (cf. Wideman 1985). As in Mrs. Purdy's classroom, students need to be encouraged, and monitored, to adopt an instructive style of help, especially during the editing phase.

(d) Writing Development

The use of a helper looks as if it may reinforce writing strategies and features that cognitive psychologists have argued must be overcome if students are to become fluent writers.

First, the stories I observed being written had a feature that is distinctive of young writers' stories. Each sentence seems to stand on its own, very much like an utterance that would constitute a child's turn at talk, in a story written by an adult. Such a turn is not the type that child speakers normally take in their own daily discourse. Rather, it is the sort of turn that we find in the stories comprising basal readers. In the latter, all sentences are simple, and all children speak in well-formed sentences. In the writing efforts that I observed, stories were strings of these sentences added together. This feature is the result of the previously noted "knowledge telling" strategy (Bereiter and Scardamalia forthcoming), where students simply list everything they can think of about a chosen topic.

The presence of a helper may reinforce the production of additive, storybook-like texts.[3] The storybook character of the sentences in collaboratively produced stories seems to be a tailor-made outcome of student collaboration. The candidacy and cloze practices are methods that allow students to collaborate. Those methods are based on the single sentence and require no connection between sentences in the story. Insofar as these practices are depended on solely to make possible, and to organize, collaboration, they may assure that "stories" will have this list-like character.

Second, the problem of topical coherence of stories may be traceable to their collaborative production. As "stand alone" texts, most of the students' stories are unsuccessful. Unlike the texts of fluent solo writers, which are written to be sensible in a relatively context-free fashion, the texts of these students are quite context-dependent. By

context here, I am referring to the topical and sequential structure of student talk carried on during collaboration. If one watches the videotapes, one can sometimes understand how a major shift, indeed jump, in topic occurs through the students' interaction and the circumstances of its occurrence. Whether collaboratively produced stories are any more disjunctive than solo produced stories awaits comparative research.

Third, collaborative stories, and their production, evidence the use of a "what's next?" planning strategy (cf. Bereiter and Scardamalia 1982). There rarely seems to be any planning in composition above and beyond the production of a single sentence. If students understand the writing task as the requirement that they fill a screen or page, and that the sentences should be "on" a topic, then collaboration may encourage end-of-nose planning. This is because the presence of a helper may be experienced as a pressure to produce text, to offer candidates.

Offering candidates gives the speaker the floor and offers the helper something to comment on, or possibly cloze. However, unless students develop a public way to do long range (beyond-the-next-sentence) planning that is feasible and that meets the constraints of the collaborative setting, planning will remain short range. By this I mean to point out the difficulty of retaining control of the story, yet allowing the other person to participate.

If the writer merely "thinks aloud" about how the story ought to go, he or she can be heard as inviting comment prior to the generation of candidate story parts. To do so would be to turn the helper into more of a full collaborator. Yet, to do the planning "in one's head" is to allow silence, or to experience pressure to speak. If the writer does not speak, then the helper is free to take the floor, or to disengage attention from the writing project. If silence ensues, it is my conjecture that the writer then has to handle the sense of the other person waiting and watching. In the talk-rich environment of collaboration, silence would be more leaden than golden. Ways to do long range planning, publicly, through speech, have to be discovered.

(e) A Caveat

The three disadvantages to collaboration listed above in section (c) all share a single premise. The premise may not be appropriate at the first grade level. Work on writing by cognitive psychologists has been at the Junior Division level and above. Students at that

level have been found to use the knowledge telling strategy, to produce topically disjunctive texts and to depend on "what's next?" planning. There has been some success with interventions aimed at moving such students beyond these ways of writing (Bereiter and Scardamalia 1982), but not wholesale changes in writing behaviour.

If the writing of Junior Division students evidences the same strategies and features found in the efforts of first graders, there may be little hope of the latter students radically altering their writing methods. Indeed, these methods may be just what they need, and all that they can handle, in writing at the first grade level. If this is so, then collaboration is not something that blocks their path to writing skills development. Again, though, the question comes back to the need to pursue comparative research across solo and collaborative modes of writing at the Primary level.

Further Advantages

We have here considered advantages and disadvantages of allowing a helper, but this consideration has been narrower than it need be. The focus to this point, as with other research (e.g., Dickinson 1985), has been on the consequences of collaboration for the acquisition of writing skills. However, for some curriculum objectives collaboration has advantages beyond facilitating writing development.

The concern has been expressed that students working at the computer may have their oral language development impeded (Zaharis 1983). This certainly cannot be true if students work together at the computer, as during word processing. Indeed, while collaborating at the computer the students that I observed engaged in all the language arts: speaking, listening, writing, and reading. Collaboration was primarily verbal, and talk filled the air during each writing session. From my observations, it appeared that the most student-student discourse around classroom tasks occurred at the computer centre, though students did talk together at the writing centre as well.

Allowing collaboration is one way for teachers to meet what the Ministry of Education has termed "the school's responsibility to create an atmosphere in which children will be encouraged to express their ideas and feelings and to find new interests and experiences to talk about" (1975, p. 36). Collaboration would seem to qualify as a task organization that can lead students to free communication of their own ideas (1975, p. 61). If the computer

centre is located close to the teacher's desk or work area, collaboration offers the additional advantage that the teacher can hear students talking and composing. The teacher thus has the opportunity to identify particular language development needs of the students (1975, p. 36). If students engage in oral reading from the screen, the teacher also has the opportunity to note needs pertaining to the development of word recognition skills.

If the teacher has a concern to foster the development of all the language use skills of the students, then allowing collaboration during word processing is a way to meet this objective. This objective may have particular salience in classrooms where students' heritage language is not English (or French, in francophone schools). In this regard, it is worth recalling that in Mrs. Purdy's Grade 1 class of twenty-three students, only three students had English as their heritage language. The other twenty students had Italian or Portuguese as the first language of their parents.[4] This mix and ratio of unilingual and bilingual students made collaboration especially fruitful as a means to meeting language arts curriculum objectives.

Summary of Advantages and Disadvantages

Collaboration provided Mrs. Purdy's students with circumstances and a task that demanded the use of all their language skills. If use of all the skills is considered by the teacher to be more important than the development during writing efforts only of writing skills, the recommendation for allowing collaboration at the Grade 1 level is unequivocal. If the development of writing skills is considered to be the sole, or primary, objective for students during word processing, then the recommendation for collaboration is more guarded.

If Grade 1 students have difficulty learning and using computer hardware and software, then technical help will be required. The greater the number of students who need this help, the more efficient it will be for teachers to depend on student helpers rather than rendering aid themselves. Unless students come to class already familiar with computers, from kindergarten or home exposure, it is likely that student helpers will be needed, by some writers, if not most. (Here I assume that the pool of helpers will constitute a minority of the students in the class, and that helpers will not need a helper when it is their turn at the computer.)

Given that helpers, for the present time, likely will be needed in Grade 1 if students are to reap the benefits of word processing, we must be mindful of the advantages and disadvantages for writing skill acquisition that may result from the use of a helper. Before briefly summarizing them, let me remind the reader of the limits of this pilot study. Only one classroom was observed. Only thirteen and one half hours of student writing were videotaped. Only one camera was used, such that not all inputting and arranging acts were captured in clear ways. Only the composing and inputting phases of writing were examined closely. Neither time nor funding allowed as close an analysis of student interaction as would be possible from an ethnomethodological perspective.

To summarize, the advantages of the use of student helpers included the following:

a) Collaboration may produce more effective learning, in general.

b) Collaboration doubles the use of a scarce resource - the computer.

c) The practices observed during composing may foster appreciation of the text as an object meaningful in ways that transcend the writer's intention.

d) Collaboration may aid the writer in developing a sense of audience, especially to the degree that the helper intervenes to enforce community standards of intelligibility.

e) The mere presence of another person during writing may be experienced by the writer as pressure toward monitoring and self-regulation of the writing process.

f) The practice of reading aloud text from the screen may foster a sense of text as discourse, as having the intonational contours of speech.

f) During inputting, the practices of verbalizing, searching, and checking should reinforce students' knowledge of spelling.

On the minus side:

a) The writer can become dependent on having a helper, thereby retarding learning of the computer hardware and software.

b) Those students most used as helpers can fall behind in their own work.

c) The presence and actions of the helper may intrude on the writer's composing efforts.

d) The presence and actions of the helper may pressure the writer to place too much emphasis on correct spelling during the composing phase of writing.

e) Collaboration may reinforce composing strategies that students must eventually drop if they are to become fluent writers.

In considering and reviewing these advantages and disadvantages several things become clear. Collaboration serves important functions in language arts. It is virtually necessary to use technical helpers at the Grade 1 level. However, the advantages, but especially the disadvantages, depend on how collaboration is organized during word processing. With the appropriate organization of the computer centre, and organization of collaboration, some of the apparent disadvantages of having a student helper can be ameliorated or overcome.

Objective Three

The third objective of this research is to suggest how collaboration can be organized in Grade 1 to take full advantage of student "experts" at word processing. As my observations were in only one classroom, where only one computer was used, I shall limit my suggestions to organizing the use of a single computer. As not much has been written on how computers ought to be set up in classrooms (cf. Daiute, in press), I shall address both how word processing centres can be organized effectively, and how they can be organized to facilitate student collaboration.

It needs to be emphasized that my recommendations are interrelated, as the reader will

see. Taking up one recommendation, without the others, may produce different results than those that I observed or anticipate.

(a) Computer Centre Organization

While there are numerous ways in which computer centres can be organized in the classroom, the location of the centre in the classroom I observed served functions that recommend consideration of this location. Mrs. Purdy placed the computer next to her desk (see appendix 1). This allowed her to overhear and monitor talk at the computer when she was at her desk. It also allowed students to turn to her, if she was not busy, and receive a quick answer to questions they might have.

The location of the computer provided for an interesting, and efficient, organization of access to the teacher by computer users. The student desk on which the computer sat was at the right side of the teacher's desk. When seated at her desk, the teacher faced the class, who sat at their desks at a right angle to the teacher. Students came around the left side of the teacher's desk, as she was sitting, to consult her. Often, a line would form to consult her. Computer users, however, moved directly from the computer centre to the teacher's right side to consult her, especially on spelling. No matter how many students were lined up on the left side of the teacher's desk, the computer using student was given the next turn to consult with the teacher. These regularities, of computer users having direct access to the teacher, and receiving the next turn to consult with the teacher, should be reinforced as a rule.

There are two reasons for this rule. First, the computer is a scarce resource and should not be left unused while the computer user is waiting in an all purpose queue. Secondly, I observed some computer users not following the regular convention, instead joining the queue on the left side of the teacher's desk. This left the computer underutilized. The teacher needs an access rule to enforce in order to dissuade computer users from joining all purpose queues.

When the teacher is away from her or his desk, a version of this rule needs to be formulated and enforced wherever a queue may form. Mrs. Purdy sometimes sat in a chair at the front of the class, working with a few students, while others were engaged in seat work. Computer users, if they needed to consult her, typically would get in any queue that had formed to meet with the teacher. In such circumstances, it would be efficient to have a

"computer users first" rule, which the teacher could invoke and enforce, as deemed necessary. Of course, there may be circumstances where the teacher would not invoke, or would relax such a rule, as when some non-computer using student has an obvious pressing need.

The computer should be set up on a low, student-height table that provides adequate space for all the hardware connected with the computer. Whether the printer is placed on the table, or is set on a cart with a lower shelf for paper, can be left to the teacher's discretion. Of course, the optimum size of any table depends on the computer, whether it has a detached keyboard, large monitor, separate disk drives, koala pad, etc. If student dictionaries receive use, it is important that there be room for students to spread out a dictionary, or to lay out the hard copy of their text. How much room will depend primarily on the size and shape of the dictionaries.

The workbooks used as dictionaries in the class I observed measured eight inches by five when closed, but when opened they measured sixteen inches wide by five inches high. Using them almost always presented problems. Students would lean them against the video screen to read them, but then seemed compelled to move them so that they could check each letter as it was input. Or they would place the dictionary on a vacant side chair, and then would have to move back and forth from looking at the chair to looking at the keyboard and the screen.

In fact, it is my sense that the dictation method of verbalizing words to be input arose as a solution to the problem of where to place the dictionary. The helper would hold and/or look at the dictionary, while dictating to the writer, who looked from the keyboard to the screen. In that this dictation practice may have positive benefits, it would be unfortunate if it fell into disuse because the dictionary placement problem was solved in some way, as with a larger table, or a typing easel. As a method for organizing collaboration, teachers may wish to suggest to students that they share the inputting task, by using the dictation method, even though there is room to place the dictionary where both the writer and helper can see it.

(b) Dictionary Use

While on the topic of dictionary use, another suggestion can be made for organizing collaboration. In the writing sessions I observed, at least one dictionary was available all the time: students made sure of that. However, that dictionary was not always the writer's.

If the helper's dictionary is used, and a new word is entered by the teacher, the helper then has that word, but the writer does not. The writer will not have that word in her or his dictionary to use at a later time, yet that word is in the story for which the writer is responsible. It is a word in which the writer expressed an interest, and of which he or she may be expected, now, to know the spelling.

The writer and helper should bring their dictionaries to the writing session, and the students and the teacher should make sure that any new words are entered by the teacher in the writer's dictionary, and not the helper's. If the helper would like to have the new word in her or his dictionary, he or she can copy the word by pencil (assuming adequate motor skills on the part of the helper). If copying the word from the writer's dictionary proves to be a useful practice, then helpers should be encouraged to bring both their dictionary and a pencil to the computer. Or, a pencil can be left at the computer, perhaps on a cord or string.

(c) Helpers

Mrs. Purdy's conception of a good helper is a student who is a good instructor, who lets the writer use the keyboard, and who knows how to operate the hardware and software. She feels that it is important both to let students choose a helper, and for the teacher to make sure that there is an adequate matching of needs, skills, and personalities between the writer and the helper. How this matching can be achieved was discussed earlier in this report, with the teacher intervening to match students when the first chosen helper appears behind in her or his work.

What is quite important is that a group of helpers be "grown" each year, in each class. My videotaping began only in May, so I am unable to speak to the care and growing of helpers. Mrs. Purdy felt it was important that as many students as show interest be encouraged to try out their pedagogic skills as early in the school year as possible. In this effort, it is important that both boys and girls be encouraged. My observations revealed boys choosing boys and girls choosing girls to be helpers. When male helpers needed advice, they would ask other boys, or the teacher. When female helpers needed advice, they would do the same thing: ask boys, or the teacher. This pattern, however, may have had to do with the fact that male students, including the most expert student helper, sat nearer the computer and the large monitor than did any female student. The pattern of male expertise, leading to male

"domination" of the computer, has shown up elsewhere in recent research on word processing, but at the Junior level (Michaels 1985).

Depending on the class, female students may have to be given special encouragement to become experts, or we may face a widening gender gap around computer use in our society. One way of offering such encouragement, without appearing to favour girls unduly, might be to make sure that female helpers are given desks near the computer. As students seated near the computer were most often asked for advice, they had additional motivation to hone their skills and to upgrade their knowledge.

Helpers must be monitored and encouraged to be instructive: to tell rather than do. On the other hand, the teacher must look out for helpers who tell too much, too often. During my observations, one student, who seemed to be demonstrating her pedagogic skills for the researcher's appreciation, dominated a writing session through questions, commands, and prompts. How she acted as a helper when not in the presence of a researcher and video equipment is not known. But her "instructive" behaviour in my presence seemed irritating to the writer, who kept repeating "I know!" Perhaps one way of growing the right kind of helper is for the teacher to model helper behaviour for potential helpers, i.e., have the teacher be the helper for noviciate helpers. Of course, such a suggestion has the unfortunate property of requiring more teacher time, when time is always a scarce resource.

While helpers can relieve the demands on teacher time, the problem has been noted that writers may become dependent on helpers. One suggestion for overcoming this problem is for helpers not to be used all the time. Their use may be necessary with some students at the beginning of the year, but it may prove helpful to reduce the ratio of aided to unaided time at the computer. Since so-called "unaided", or solo, writing, in fact, involved the teacher in advice giving, the teacher should be able to judge easily which students can work without a helper. As we clarify the advantages and disadvantages of collaboration through further research, we may be able to develop a sense of whether it is wise to try to wean writers from helpers in Grade 1. At present, though, the concern would be to identify students who appear to be dependent on helpers, and see what happens as they work on their own at the computer. These students, in particular, must understand that collaboration is not the standard way of writing, and that they all must aim to become self-sufficient at using the computer. The use of helpers is simply a way of extending and using what Vygotsky (1978) called the zone of proximal development, where students are aided to do things they cannot yet, but later will, be able to do alone (cf. Griffin and Cole 1984).

Finally, over the past three years, Mrs. Purdy has found that allowing one helper generally is preferable to allowing two or more students to help at the same time. With more than one helper, she reports the tendency toward more off-task behaviour. However, she reports occasions when up to five students have collaborated successfully. As with any rule, the classroom rule regarding number of helpers should be enforced only to the degree that enforcement furthers the objectives taken to be most important at the time, in situ.

(d) Large Monitor

While my research did not focus on Mrs. Purdy's innovation of using a large TV monitor connected to the computer, the benefits of having such a monitor were clear. As mentioned previously, students were able to monitor the completion of turns at word processing, enabling the next student to notice when her or his turn had come. If the next student did not notice that her or his turn had arrived, other students did. Those other students often would bid to become the helper, and would call out to the next student that her or his turn had come.

Originally, the large monitor was connected to the computer facing the whole class, so that Mrs. Purdy could give whole class instruction on how the Write/One program works, and what the screen looks like when the program is run. She reports that after one session of instruction she simply left the large monitor on. The students showed interest in watching what was happening while one of their classmates was working at the computer. Mrs. Purdy decided to leave the large monitor hooked up because it allowed students to satisfy their curiosity about what was being done at the computer. Without the large monitor hooked up, she reports that more students get up and wander over to the computer centre, just to watch, and to offer their suggestions.

When I first learned about the use of the large monitor, my immediate question was whether or not it was a source of distraction. During my observations, at the end of the school year, the monitor seemed to be just another piece of classroom furniture. But it was furniture to which students attended. Some students monitored it more than others; some rarely paid attention to it. For whatever reason, students seated closest to the monitor (see appendix 1) paid the most attention. They would offer comments if they saw something that they regarded as wrong on the screen, e.g., a misplaced period. The most knowledgeable student helper would magically appear when it came time for a story to be printed. He would

turn on the printer and check to see that the paper was properly loaded and turned up to the correct point for printing. His magic relied on watching the large monitor.

The other intriguing use of the monitor was made by the teacher. From her desk she was able to hear students talking during their collaborative efforts, and to check story development by looking at the large monitor. From anywhere in the room she could monitor the story being written. She could see when deletion errors erased a whole line of text, and note progress, or lack of progress on the story. The use of the monitor, and its functions, deserves further research, but it appears to be a promising innovation for making writing an even more public phenomenon in the classroom. Students can read what others write, as they write it, giving them models for writing, and furnishing reading material at, or near, their own reading levels.

(e) Printing

One difficulty with writing on a computer is that, unlike a typewriter, after you strike a key you do not have a hard copy of your entry. Printing occurs later, usually. And printing takes time. The single largest cause of underutilization of the computer in the classroom I observed was the time required to print copies of the writer's story for the class. The children enjoyed receiving copies of their classmates' work, and the writers seemed to derive some satisfaction from passing their story out. However, printing twenty-three, or more, copies of a story, even a seven-line story, is time consuming.

The version of Write/One used last year allowed students to specify up to three copies of their story to be printed. Printing twenty-three copies set up a nice numeracy event. Students had to count how many copies had been printed, then decide if three more, or less than three more were needed. This involved one student going to the printer, counting copies/pages of printout, then telling the student at the computer how many had been printed. Occasionally, the student at the computer would disbelieve the count, or the person counting would appear uncertain. Then the student at the computer would go and count, comparing her or his count with the other student's. This was a functional numeracy activity: students needed to know how many copies were printed. If the teacher regards this activity as useful, some time could be saved if an abacus was placed at the computer centre, so that students could mark off how many copies they had requested to be printed each time the print menu appeared on the screen.

If this numeracy activity is regarded as less important than increasing utilization of the computer and, and only if, there are the resources to reduce the amount of time students spend printing stories, then teachers may prefer to organize printing in different ways. If there is a teacher's aide, then the printing of stories might be left to the aide, to be done while he or she is carrying out other tasks. If the teacher is spending the lunch period in the classroom, or spends time in the room before or after class, then the teacher could run off the stories. These solutions, especially solutions involving more use of the teachers' "discretionary" time, are dispreferred. In my experience, teachers at all levels are overburdened with tasks and demands. Especially at the Primary level, I do not expect that there is any spare time for teachers to take on more tasks.

The preferred solutions to the print time problem are software and hardware dependent. The software solution is to write, or modify, word processing programs so that they offer the option to print up to, say forty copies, with one command. With this solution, the computer would still be underutilized, but at least the computer using students would be free to go back to their desks and engage in other activities.

The hardware solution must be combined with the software solution. The software must have the capability to print multilple copies from the print menu, like the program New Word, without the use of overlay files, as in WordStar's MailMerge program. If the software has this capability, then a print buffer can be added to the printer. The result would be to free up the computer to be used while the printer produces "n" copies of the previous story. The software and hardware solutions together should increase the utilization of the computer in real time by at least twenty-five times perhaps more. Especially with print buffers that can be inserted in the printer itself, e.g., the Wizzard-EBI card for Epson printers, the added cost is small compared to the value of freeing up a scarce resource for more extensive use.

(f) Hardware and Software

The last category of organizational considerations has to do with the computer, its layout, and the software chosen for word processing.

As we all know, the standard computer keyboard is an adaptation of the typewriter QWERTY keyboard, with extra keys--usually serving executive functions--clustered around its edges. While there have been efforts to design more ergonomically sound keyboards, even split keyboards with a separate board for each hand, and efforts to supplant the keyboard with mice, trackballs, joysticks, and microphones, all these efforts, with one exception, presume that the computer has one user. The one exception is the use of the computer to play competitive games, where each player has a joystick, or its functional equivalent. The most sophisticated technology for collaboration during inputting that I have observed, is the CoLab Project at Xerox Palo Alto Research Center (Foster 1984). In the CoLab environment each collaborator has a screen and a keyboard, though what appears on any one person's screen can be made to appear on anyone, or everyone, else's screen. While mice are used, no inputting devices receive shared use.

During collaboration at the computer centre in Mrs. Purdy's Grade 1 class, at least two students were using the keyboard. As I have outlined, the differentiation of writing qua "transcribing" at the computer gives us two classes of action: inputting and arranging. These two classes, within some software program environment, are carried out through using display keys and executive keys. This technologically based differentiation of transcribing acts was mirrored at the social organizational level by a differentiation of writer and helper rights and responsibilities.

At the early Primary level, it turns out that collaboration, of the sort that I observed, is facilitated by certain keyboard configurations and certain software command structures. To say this is also to say that some keyboard configurations and some word processing software can be expected to frustrate collaboration more than facilitate it.

Consider the keyboard of the Apple II+ (see appendix 5). As with most keyboards, the executive keys are set to the right and to the left of the display keys. Running along the bottom of the keyboard is the space bar. There are no dedicated function keys, as found on the left side of the IBM PC keyboard, and across the top of the ICON keyboard, and on the right side of the Commodore 16, 20, and 64 computers. There is no trackball as found on the ICON. As well, unlike the IBM PC, the ICON, the Apple IIe, and the Commodore 2000, 4000, and 8000 series, there is no numeric keypad on the right side of the Apple II+.

The use of the computer, or more precisely, the use of the keyboard in the writing sessions I videotaped was the focus of "computer struggles." As discussed above, students vied with each other for what I have called the "driver's seat," the chair directly

in front of the keyboard. Since the Apple II+ does not have a detachable keyboard, the chair was also in front of the computer.

When there were two helpers, one would sit to the left and the other to the right of the driver's seat. When there was only one helper, which was the majority of the time, that helper usually sat to the right. At the Apple II+, running Write/One, this placement makes good sense, though there is no way of determining whether helpers understood this fact.

As discussed in Part 1 of this report, the executive keys on the Apple II+ used within the Write/One program environment are the control key, the shift key (either one), the space bar, the left arrow key (for deletion), right arrow key (for insertion), and the return key. Left and right cursor movement are achieved by holding down a shift key while depressing the left angle-bracket/comma key or the right angle-bracket/period key. The control key is only used, in combination with either the T or B keys, for up or down cursor movement. The latter movement was used mainly during the editing phase of writing.

Given the use of these keys, as they are arranged on the Apple keyboard, and as they function within Write/One, the student who tries to help from the left side of the writer constantly will have to invade the writer's space to reach across and hit the left arrow key to delete a letter, or hold down a shift key and hit the left or right cursor key, or press the return key. The left arrow/delete key was the key most used by helpers. The control key was the least used, during the composing and inputting phase. Hence, for this keyboard, and for the software used, the helper will have the easiest time of it if he or she is seated to the right of the writer.

With regard to the objective of facilitating collaboration at the early Primary level, hardware and software that are preferable are those that allow the technical helper to offer aid easily, from one side or the other of the keyboard. If software is function key dependent, like Multimate on the IBM PC, and if the delete key is not on the same side of the keyboard as the function keys, then the software is not good for the type of collaboration I observed. If the word processing software requires extensive use of the control key during inputting, as for cursor movement, but does not have independent cursor keys on the right side of the keyboard, then the software is not good for technical collaborators.

What is good for facilitating collaboration is the Apple II+ or IIe, as well as any of the Commodore PET computers. These computers are useful at the Grade 1 level, however, only when running simple word processing software, like Write/One or the Toronto Board of Education's Story Writer.[5]

As the Government of Ontario moves ahead to ensure that students in this province have access to state of the art educational computers, it will be quite important to make sure that word processing programs to be used in the early grades are simple to use. If collaboration is to be fostered, educators must make sure that software that minimizes the likelihood of computer struggles to control access to the keyboard is developed and used. As long as there is only one delete key on the keyboard, and it is on the right side, preferable word processing software will be that which makes use of keys on the right side of the keyboard as executive keys.

Conclusion

This research represents more of a beginning than a conclusion. In order to more fully comprehend the nature and the advantages and disadvantages of collaborative writing at the computer, comparative research must be done on solo and collaborative writing, with pencils and computers. In terms of what already has been discovered by focusing solely on collaborative use of the computer, a direction for further work suggests itself. The research presented here looked at collaboration that was minimally constrained in terms of task objectives and procedures to be followed. In line with interventions carried out by cognitive psychologists who have studied writing, it would be interesting to study task organizations that include helper practices for facilitating the development of writer self-monitoring, self-regulation, and sense of audience.

As we continue to inquire into collaborative computer use for writing it will be important to stretch our imaginations to notice and recover new possibilities for education that the computer, and collaboration at the computer, open up. We must work from the position that the computer is not just a more efficient pencil, paper, and eraser, just as the automobile is not just a more efficient horse. We must look at what uses of the computer are possible, including those that engineers and teachers may not have intended or foreseen.

The same must be said about collaborative writing at the computer. It should not be seen as just solo-writing-with-a-helper. The social mediation of composition and inputting make collaborative writing something more, and different, than solo writing. We must discover, comprehend, and appreciate the new interactional structures and pedagogic functions that are possible through collaboration.

This research has sought to understand the structures of collaborative writing, but in so doing has come to understand the social organization of collaboration as having value for intertwining and developing all the language arts. While writing is the task, the methods include speaking, listening, and reading. The pleasant irony here is that the most sophisticated technology in our schools furthers learning of the most basic skills. But the technology does not do it of itself. The issue, as always, is how we use the technology.

Notes

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1. The basis for helper privilege only can be conjectured. Helpers are persons who at other times are writers, and are thus able to help compose. If we freely vary the circumstances, reflection reveals that it would be odd in this classroom to find someone chosen to be a helper, yet not be permitted to join in composing the story. This seems to me to be something of a moral issue. If the writer were to disallow collaboration on composition, the helper would thereby be formulated as somehow not being worthy enough to collaborate. Since selection of helpers may well fall along friendship lines, disallowing help on composition would jeopardize student friendships.
2. This usage was adopted during the field observations in May. In January, 1985 I spent time at Xerox Palo Alto Research Park and discovered a grammatically related usage. When asking another person if he or she would like to operate the computer as it runs a certain program, personnel at PARC would say something like "Would you like to drive?" When I inquired into the genesis of this usage, I was told that it was picked up from researchers working at MIT who had recently visited PARC. Driving seems an appropriate metaphor for user controlled software, as opposed to designer controlled software (e.g., CAI), which can be said to drive the user.
3. Research must be done that compares stories written in the solo and collaborative modes at the computer to determine the truth of a sensible hypothesis: students who collaborate write more because together they have more knowledge to "tell" than solo writers.

   Research reported during the writing of this report (Daiute 1985) found that, among a selection of fourth and fifth graders, stories and sentences were longer in the collaborative mode only half the time when the same writers were compared in both modes. It should be noted that collaboration was "full" in Daiute's study. Both students were considered, and understood themselves, to be writers.
4. In spite of the predominance of bilingual students, on the videotapes non-English terms rarely were used. When it sounds as if such terms were used, it was in instances of soliloquy. In these instances students seemed to be thinking out loud, as when trying to generate a cloze item for a candidate story part.

5. The Write/One program comes in two versions, one for Apple II series computers, and one for Commodore PET computers. To the best of my knowledge, the Story Writer program runs only on Commodore PET computers.

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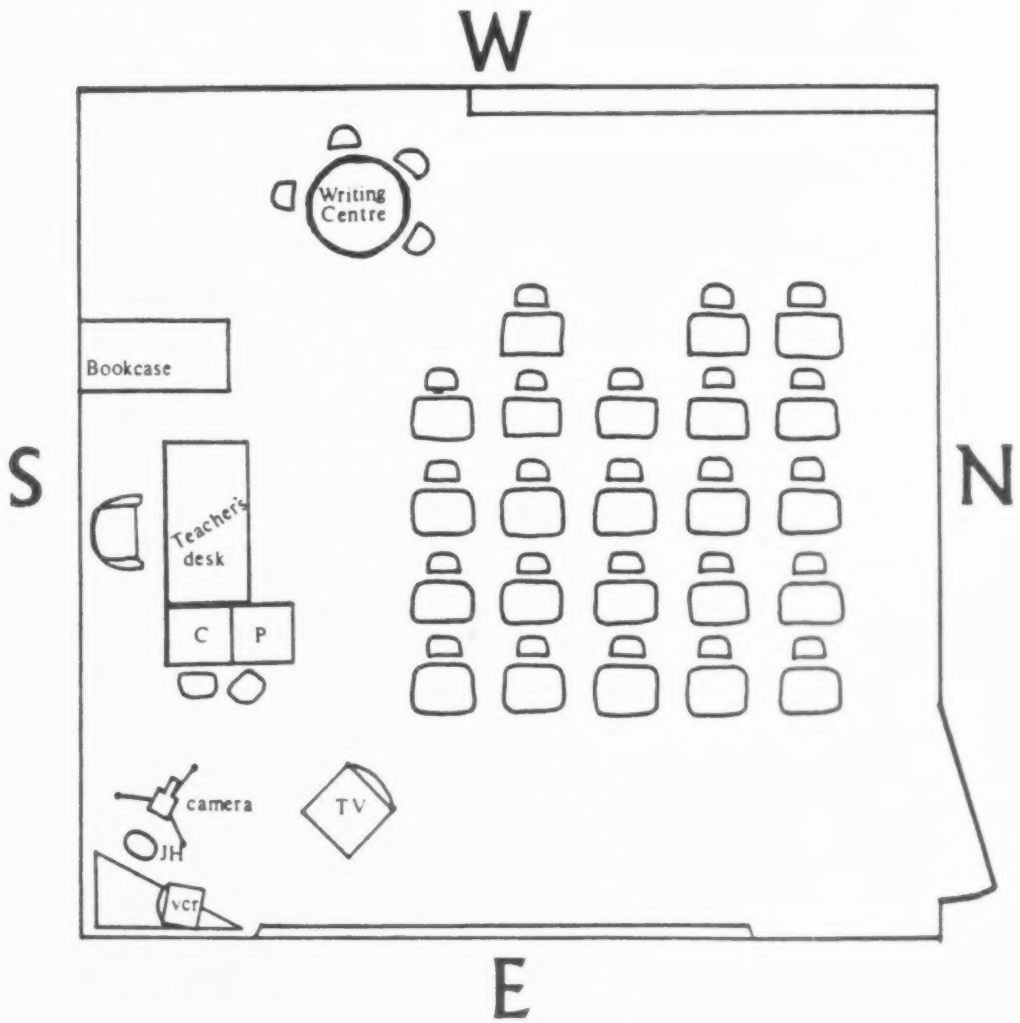
APPENDIX 1

CLASSROOM DIAGRAM: Mrs. Purdy's Grade 1 Classroom, May, 1984

Legend:

C = computer P = printer TV = large monitor

vcr = videorecorder JH = principal investigator



drawing by C. Bennett

APPENDIX 2

TRANSCRIPT

The following is a transcript of a small segment of interaction around the story "It's Spring" by Vince, with help by Norm. The students are concerned with composing and inputting the third sentence of the story. Transcription conventions are detailed in appendix 3

V: 'We can play:::tag'..No...'The sun is bright'.'The sun is bright in spring'.
N: In spring?
V: Ye::sss*.'The' T*oop! *I thot it was a
dat.*.**..*..*..*The..Thuh::..**((V moves cursor to next line))..((N leaves and goes to his desk,putting away his pencil and paper))<
V: <The S UN. The SUN heh heh hmf. Know what I was gonna write? BSUN How's znt ((seems to notice that N is gone, cutting short zat into znt)) sst...that an::d
J?: - You see..you see two blues, so you put two blues/
?: - /yeah, ok/
J: - /You see fours, you put fours
N: ((returning to the computer, kneeling on the chair to the right of V, speaking at/to V)) Yes, you are.schoom-schoom-schoom. youmt-youmt-youmt-ymn..Make a: fifty ((points to key on top row of keyboard))
V: awright, the sun was UUUU**
N?: (sun me sun eth no mazda silly)
V: Fifty! Fifty?
N: hrrngth/
V: /why make
N: cuzz, do five zero**r't there, fifty
V: ga! ((appears that V deletes the 50)).If you do that again you'll get a knucklehead like this.
N: I'm-not-guh/
V: /fit-uh ((sound of a punch into palm of V's hand))
N: (dare ya)
V: The sun is::**/
N: (/old the sun costs colda hurryup) hot/
V: /is::
N: 'hot'
?: (p is maught)
N: */
V: /'bright'
N: /*/
V: /no: 'bright'
N: 'hot'!
V: 'burright'
N: (ho:::t)
V: 'bright and hot', how's that? yeah

The sentence as finally input reads: "The sun is bright and hot."

APPENDIX 3

TRANSCRIPTION CONVENTIONS

The following conventions have been modified, elaborated and extended from the protocols used in conversation analysis (cf. Sacks, Schegloff, and Jefferson 1974). The conventions are presented in the order of their use in the "Vince and Norm" transcript.

V:	speaker's first initial
'	marks candidate text piece
:	marks an elongation of a sound
.	represents approximately half second pause
*	marks keystroke
S	upper case letters may represent pronounced letters, depending on context
*	marks hit of space bar
(( ))	encloses transcriber's remarks
<<	marks events/turns as continuing without a pause, i.e., what begins with a < is not offered as a separate next turn by the speaker
J?:	possible speaker's first initial
-	marks indented talk as "side talk" by other students
/	at end of one turn and beginning of next: marks latched turn, with no gap and no overlap between turns
-	pronunciation of hyphenated words is run together
( )	encloses what it sounds like the speaker said
F	emphasis
F	heavy emphasis

APPENDIX 4

Computer Centre Photographs

Picture A:

Writer at computer, with helper seated at her right. Note "dictionary" to left of computer. The printer is in front of the helper. The computer centre table is perpendicular to the teacher's desk (at left side of picture), with the centre of the classroom being forward and to the right of the helper.

Picture B.

A keyboard "struggle." The helper is lifting the writer's hand from its descent toward the keyboard.

Picture C.

A shot of the computer centre from the middle of the classroom. The printer, disk drive, and monitor appear on the right hand side of the picture. The large monitor facing the class mirrors what appears on the computer's video monitor. The angled monitor below the large one is used primarily to guide camerawork.

APPENDIX 5

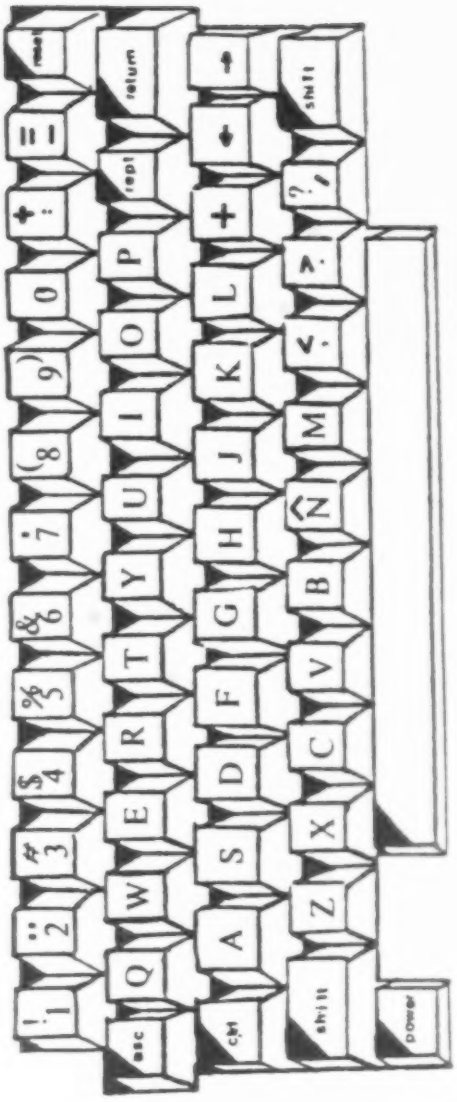
APPLE II+ KEYBOARD

Note the keys with the shaded corners: esc, ctrl, shift, power, space bar, shift, rept, return, and reset.

In the composing and inputting phase of writing, these are the "executive" keys. The rest of the keys used in this phase are "display" keys.

In this phase the left angle-bracket/comma key and right angle-bracket/period key are interesting. They are display keys, but when depressed jointly with a shift key they operate as left cursor and right cursor keys, respectively.

Note the placement of the executive keys. These keys are arranged around the periphery of the display keys. The user who is "centred" at the keyboard has access to all keys. A helper has easiest access to executive keys on the side of the keyboard where he or she sits.



drawing by C. Bennett